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SURGICAL ASPECTS OF UNDULANT FEVER*

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DAYTON, OHIO

WITHIN the past three years, the physicians of this country have become acutely conscious of the importance of undulant fever as a grave public health problem. Recent medical literature has brought convincing evidence of the widespread distribution of the disease in all parts of the United States. During the past one and one-half years, 76 cases of undulant fever have been discovered in and about Dayton, Ohio. A report of the clinicopathological findings in 63 of these cases appears elsewhere.[1] Hardy,[2] of Iowa, has collected data on more than 1000 cases in this country, the great majority of which have been recognized during the past three years.

The writers have encountered no published report in which the surgical aspects of this disease have been especially emphasized. The purpose of this undertaking is to point out that the patient with undulant fever frequently presents serious diagnostic problems to the surgeon.

Before entering upon a discussion of the surgical significance of undulant fever, it would be well to review briefly the historical development of our present knowledge of the disease as it occurs in this country. In 1918, Alice C. Evans,[3] bacteriologist of the United States Public Health Service, discovered that the organism of contagious abortion of cattle and other domestic animals, the so-called *Bacillus abortus* of Bang, is indistinguishable morphologically, biochemically, culturally and by ordinary agglutination tests from the organism of Malta fever, Mediterranean fever or goat fever (*Micrococcus melitensis* of Bruce). This important discovery led Evans to prophesy that clinical investigation would probably reveal that both organisms possessed similar pathogenicity for human beings. Subsequent studies[4] led Evans to believe that cattle and hogs were sources of human infection.

Keefer,[5] of Baltimore, reported the first American case of human infection with *Brucella abortus*, in 1924. Two years later, Carpenter and Merriam[6] reported two cases of undulant fever in university students at Ithaca, New York, from whose blood Carpenter recovered *Brucella abortus*. Two heifers in their first pregnancy aborted after inoculation with these cultures; the organism was recovered from the placentas and fetal organs. The milk consumed by one of the patients was found to be heavily infested with exceptionally virulent strains of *Brucella abortus*.

In 1927, Carpenter[7] reported 10 cases of undulant fever in man. From the blood of each patient he recovered an organism indistinguishable from the organism of contagious abortion. Using the cultures thus obtained, Carpenter inoculated 5 pregnant heifers which did not react to the agglutination test and which were purchased from abortion-free herds. The

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5 animals aborted from five to twenty days after inoculation, and the same organism was recovered from the fetus, placenta and colostrum of each of the heifers. One heifer was not sacrificed until six and one-half months after aborting, during which time she continued to eliminate the organism in large numbers in her milk.

This magnificent pioneer work of Evans and Carpenter demonstrated that the organism which produces contagious abortion in cattle and other domestic animals (sheep, goats, hogs, mules, asses and dogs) is capable of producing in human beings a disease clinically, bacteriologically and serologically indistinguishable from the Mediterranean type of Malta fever, caused by the ingestion of goats' milk.

More recent reports tell of the widespread distribution of the disease in this country. In June, 1928, Sensenich and Giordano[8] reported 7 cases in South Bend, Indiana; a more recent report[9] increases the number to 35. Kern[10] analyzed 36 reported cases and added 3 from Pennsylvania. Orr and Huddleson[11] have investigated 31 cases in Michigan.

Farbar and Mathews[12] have reported an epidemic of undulant fever among 25 students and 1 laundress at Earlham College, Richmond, Indiana. This report possesses great value because of the fact that the patients and their milk supply were confined to a college campus. It was possible, therefore, to demonstrate the relationship between the infection in human beings and in the college herd. Of the 23 cows which constituted the college herd, 7 gave positive agglutination reactions for infectious abortion. *Brucella abortus* was recovered from the milk of 3 reactors. The cows had never been in contact with goats or breeding pigs. All of the human victims of the infection were consumers of raw milk or cream from this herd. The institution of pasteurization terminated the epidemic.

During the past year, Hardy[13] has investigated 125 cases in Iowa, all of which showed an agglutinin titer above 1:80 and the organism was recovered from the blood of 22 patients. Four of the Iowa cases terminated fatally.

From the foregoing it becomes at once apparent that the disease is invariably found to be widely prevalent when an earnest attempt is made to learn of the incidence of the disease in a given locality.

SOURCES OF INFECTION

Although the pathogenicity of *Brucella abortus* for man was not known until a relatively short time ago, it is highly probable that this disease has existed in an unrecognized form for many years. It is now firmly established that the common source of infection of human beings is the ingestion of raw milk or unpasteurized dairy products. In every one of the Dayton cases in which a causal relationship could be established the disease occurred in individuals who were consumers of unpasteurized milk. We encountered no cases of direct porcine or caprine origin.

Contagious abortion is widely prevalent among cattle in this country. It has been stated that 90 per cent of the herds of Connecticut are infected;[10] 86 per cent of the herds of Pennsylvania are thought to be infected.[10] Our own studies lead us to believe that infectious abortion is widespread in southern Ohio. Serological studies of 63 cattle, including 4 calves and 3 bulls, of 5 herds which supplied milk to 10 of the patients in the Dayton series, revealed that all but the 4 calves gave positive serological evidence of *Brucella abortus* infection. Five of the cows were found to be eliminating *Brucella abortus* in their milk. Blood cultures from 5 of the patients yielded cultures of *Brucella abortus* serologically identical with those recovered from the cows' milk. Four strains of *Brucella abortus* (1 from human blood, 3 from cow's milk) were submitted to Huddleson, who found them to be of the bovine variety. Our findings lend no support to the belief of some investigators that the porcine rather than the bovine variety

of *Brucella abortus* is the usual cause of undulant fever in this country, although it seems probable that in a few cases the porcine strain has been transmitted to cows and thence to man.

Schroeder and Cotton[14] have recovered *Brucella abortus* from the milk of 83.5 per cent of cows whose sera showed specific agglutinins for this organism. Carpenter[15] has isolated *Brucella abortus* from the milk of 66 per cent of a group of cows which had either aborted or had retained placenta at least once during three previous gestation periods. It is of great importance to observe that Carpenter recovered the organism from the milk of 3 cows whose sera showed no anti-*abortus* agglutinins. Carpenter and King[16] have reported the results of an extensive survey of the raw milk supply to sixty-seven small towns, two small cities, and one city of 200,000. *Brucella abortus* was found in 20.4 per cent of the samples examined. The raw milk supply to these towns and cities was produced by herds known to be extensively infected with *Brucella abortus*.

While the great majority of human cases of *Brucella abortus* infection have resulted from the ingestion of unpasteurized milk and dairy products, the disease also affects packing house workers, meat handlers, farmers, and veterinarians as a result of direct contact with animal tissues infected with *Brucella abortus*. Hardy[17] has conducted animal experimentations which seem to indicate that *Brucella abortus*, like *Bacterium tularense*, possesses the ability to penetrate unbroken skin.

CLINICAL MANIFESTATIONS

Practically every writer on this subject has stated that undulant fever produces no well-defined clinical picture. Our experience has not been in accord with this widely accepted belief. In over one-third of the Dayton cases of undulant fever, the initial clinical diagnosis was undulant fever. We have discovered that once a physician has become familiar with the clinical characteristics of the disease, he experiences no difficulties in recognizing it.

Undulant fever is commonly confused with four diseases: typhoid fever, malaria, tuberculosis and influenza. Less commonly it has been mistaken for rheumatic fever or for subacute bacterial endocarditis. In many cases the physician has finally been forced to a consideration of undulant fever after repeated negative Widal reactions, the failure to find the plasmodium of malaria and the inability to elicit physical signs or obtain roentgenographic evidence of tuberculosis.

Most writers have stated that the disease occurs more commonly in men than in women, in a ratio of about 4 to 1. In our experience, both sexes have been affected about equally. The disease is most common between the ages of twenty and forty. Children appear to be relatively immune; this immunity in children appears to parallel that of calves. The disease frequently affects more than one member of a family.

The incubation period is difficult to establish because it is often impossible to determine exactly when infection occurred. It has been stated to vary from six to fourteen days.

The onset symptoms usually present nothing of a characteristic nature, the early signs being those of a mild general infection. The patient usually complains first of fever, chills and sweats, accompanied by more or less prostration. The patient becomes vaguely aware of an afternoon or evening rise of temperature, accompanied by headache and pains in the muscles, joints, back and extremities. The elevation of temperature is usually accompanied by chills which are usually followed by sweats. The perspiration is frequently of a drenching character and usually occurs during the night. Many have observed that the sweat has a rather distinctive sweetish, fetid odor. During this period the patient is frequently not incapacitated by his illness and the

general appearance belies the objective clinical findings. In many instances the patient does not present a febrile appearance, even though the temperature may be 102°F. or 103°F. at the time. At this period of the disease it is easily confused with influenza, typhoid fever or malaria. The absence of respiratory symptoms in undulant fever is an aid in eliminating influenza. The diarrhea, delirium and "typhoid state" which characterize typhoid fever serve to distinguish it from undulant fever, in which constipation is the outstanding gastrointestinal complaint. Delirium is infrequent and the mental state is clear in undulant fever.

The fever usually follows a somewhat characteristic course with remission or intermission in the morning, during which time the patient feels very much improved, and elevation of temperature in the afternoon or evening during which time the patient complains of chilliness, feverishness and weakness. The fever occasionally reaches 105°F. or 106°F. The average maximum height in the Dayton series of cases was 103°F. The pulse rate is usually disproportionately slow during the elevations of temperature. The matutinal remissions and nocturnal exacerbations of fever may last from one week to several months, the average duration of illness being about three months. Relapses may occur a few weeks or months following apparent recovery. Undulations of fever, which give the disease its name, have not been frequent in our experience, having occurred in but 7 instances. In the majority of our cases there has been but one febrile wave, lasting from one week to three months. In some instances the disease persists for several years. In one of our cases there is convincing evidence that the disease has recurred at irregular intervals for eight years.

Loss of body weight is an almost constant finding. Many of our patients have lost from 25 to 50 pounds during the acute phase of the illness. There seems to be a direct relationship between the height of the fever, the drenching character of the sweats and the loss of weight. In those individuals who have experienced excessive perspiration night after night the loss has been greatest. The outstanding neurological findings during the height of the disease are headache, dizziness, restlessness and insomnia. The tongue usually becomes coated with a yellowish fur. The breath is frequently fetid and many patients complain of a disagreeable taste.

In about one-half of our cases and of those previously reported, tenderness or pain of the joints was an outstanding feature of the disease. In 3 of the Dayton cases the pressure of migrating pain and swelling in the larger joints led to an initial diagnosis of acute rheumatic fever. Hydrarthrosis has occurred in several cases and the organism has been recovered from the aspirated joint-fluid. Permanent impairment of the involved joints does not usually occur. Many of the cases of undulant fever in which the joint manifestations dominate the clinical picture have become diagnostic problems for the orthopedic surgeon.

Probably the most important surgical consideration of undulant fever lies in the frequent occurrence of abdominal pain during the acute manifestations of the disease. Abdominal pain was a prominent feature of the disease in 13 of the Dayton cases. Among the 125 cases studied by Hardy abdominal pain was present in 40 cases; in 10 of these cases it was the major symptom, and was a marked feature of the disease in 24 other cases. The abdominal pain has occurred at all periods of the disease but is most common early in its course. In the cases studied by the writers the pain was located in the epigastrium in 5 instances, in the right upper quadrant in 4, and in the right lower quadrant in 4. In 3 instances of sudden right lower quadrant pain with fever, appendectomy was performed. In 1 instance a gangrenous appendix was found. In the other 2 a

normal appendix was removed. In the latter cases the surgeons requested the agglutination test for undulant fever after operation in an effort to find the real cause of abdominal pain. After the agglutination test was found to be positive a typical undulant fever history was elicited in both cases.

During the recent meetings of the American Society of Clinical Pathologists and the American Medical Association at Portland, Oregon, symposia on undulant fever were conducted. One of us (W. M. S.) made careful inquiry of those who have done the outstanding work on undulant fever regarding the frequency of abdominal operations as a result of mistaken diagnoses of appendicitis or cholecystitis in cases of undulant fever. It was learned that at least 12 appendectomies and 2 cholecystectomies have been performed upon patients suffering from undulant fever. The pathological studies of the appendices and gall bladders showed no evidence of any active inflammatory process.

In one of the Dayton cases cholecystectomy was seriously considered because of the sharp upper right quadrant pain associated with fever, chills and sweats.

These findings lead at once to the conclusion that many patients with undulant fever will present some clinical evidence of appendicitis or cholecystitis. It becomes of great importance, therefore, that the surgeon should be aware of the characteristics of this disease in order to avoid unnecessary surgical interventions.

Because of the unique features of one case of undulant fever in which suppurative appendicitis was a complication, an abstract of the history, physical findings and laboratory data is presented:

Mr. G. B., aged thirty-seven, a proprietor of an automobile tire and battery store, was admitted to the Miami Valley Hospital, Dayton, Ohio, on November 21, 1928. With the exception of a rather severe illness with lobar pneumonia in 1918, Mr. B. had enjoyed excellent health throughout his life time. Three weeks before admission, he observed that he felt well during the morning, but during the afternoon he suffered from frontal and occiptal headache, felt feverish and fatigued. During this three weeks' period he experienced a chill in the early evening, followed by a profuse sweat, with a peculiar sour rancid odor. During this period he had very little desire for food, although previously his appetite had been excellent, and he lost about 10 pounds in weight.

On the day of admission to the hospital his evening temperature reached 103°F. At 3:00 A.M. the day after admission, he awoke with severe abdominal pain and felt nauseated. He vomited soon after this. At 10:00 A.M. the temperature was 98.8°F. The pain became localized over MacBurney's point with marked tenderness on slight pressure. At 3:00 P.M. the temperature was 100°F., the same localizing abdominal signs were present and a blood count made at this time showed 6000 leucocytes, 62 per cent of which were polymorphonuclears, the other white cells being equally divided between large and small lymphocytes. Appendectomy was performed by one of us (L. G. B.) and a gangrenous appendix was removed. The next day the highest temperature was 101°F. On the third day after operation the 8:00 A.M. temperature was 100.4°F. The following day the 8:00 A.M. temperature was 100°F., while the 8:00 P.M. temperature was 105°F. Blood submitted for Widal reaction and for agglutination reactions with *Brucella abortus* and *Brucella melitensis* on the second day after appendectomy was found to be negative for typhosus, paratyphosus A and paratyphosus B agglutination, but showed agglutination in all dilutions to 1:1280 with *Brucella abortus* and *Brucella melitensis*. Unfortunately, undulant fever was not suspected at the time of appendectomy and no cultures were made of the appendix. Miscroscopic sections of the appendix showed the usual picture of acute suppurative and gangrenous appendicitis. During the remaining sixteen days of the patient's stay in the hospital the temperature was quite uniformly 100°F. in the morning and 103°F. in the evening (see Fig. 1).

He returned to his home at the end of this period where he experienced the same nocturnal exacerbations of fever for the next month, although the maximum temperature gradually fell to 101°F. At this time a vaccine was

prepared, standardized to two billion killed *Brucella abortus* organisms per cubic centimeter. Deep subcutaneous injections of ¼ c.c. were given every third day for 3 injections, followed by injections of ½ c.c. at three day intervals for 3 injections and 6 injections of 1 c.c. at three day intervals. About two hours after the first injection of ¼ c.c. a sharp rise in temperature to 103°F. was experienced, followed by a chill and drenching perspiration. During the next two days the temperature remained at the normal level. After the second injection a rise in temperature to 101°F. was experienced followed by three days of normal temperature. After each of the three succeeding injections a slight elevation of temperature occurred but the temperature rapidly returned to normal and has remained so.

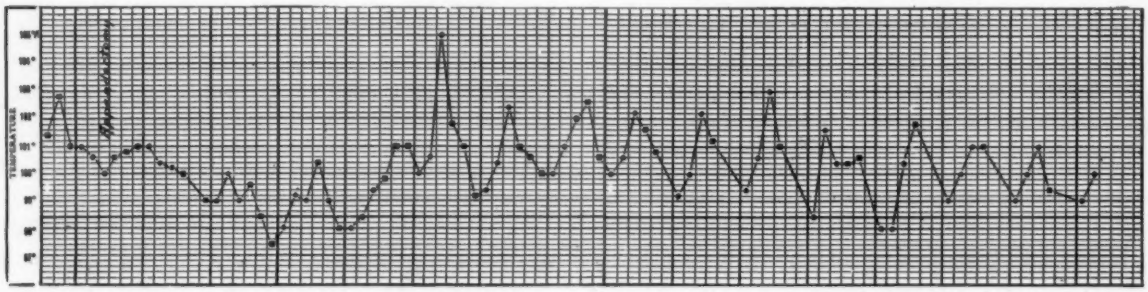

FIG. 1. Fever curve in case of undulant fever with complicating acute suppurative appendicitis showing characteristic matutinal remission or intermission and nocturnal elevation of temperature, during sixteen day period of hospitalization. Acute appendicitis developed during third week of illness.

Serum of Mr. B., collected on November 24, 1928, and on January 6, 1929, was found to agglutinate *Brucella abortus* and *Brucella melitensis* in all dilutions to 1:1280. Specimens submitted to the Hygienic Laboratory of the United States Public Health Service at Washington and to the Ohio State Health Laboratories gave similar results. Repeated blood and urine cultures were negative for *Brucella abortus*.

Investigation revealed that Mr. B. had been a raw milk drinker for many months. It was learned that the milk was obtained from a herd of 7 cows in a dairy in an adjacent town. Blood was obtained from each of the cows comprising this small herd. Every cow in the herd showed positive agglutination with *Brucella abortus* and *Brucella melitensis*, in titers varying from 1:160 to 1:1280. Milk was then obtained from each of the cows; from two, *Brucella abortus* was recovered in large numbers from the milk. The organism thus recovered agglutinated promptly with the serum of the cows from which they had been recovered and they also agglutinated promptly with the serum of Mr. B. in a titer of 1:1280. Cultures of the organism submitted to Huddleson, at Michigan State College, were identified by him as being of the bovine type.

In this case the development of an acute supprative appendicitis was probably unrelated to the undulant fever. The presence of *Brucella abortus* infection in all of the cows of the herd which supplied Mr. B.'s milk, the iso-agglutination of the organisms recovered with the bovine sera and that of Mr. B. would seem to establish quite definitely the causal relationship in this case between the infection in the cows and that of Mr. B.

Brucella abortus exhibits a predilection for the genital tract of cattle. There is convincing evidence that the same selectivity occurs in human beings. Painful swelling of the testes was a prominent feature of the disease in 12 of our cases and in 40 of Hardy's cases. The elimination of the organism in the urine has been a common finding. In the bull, the infection frequently gives rise to a seminal vesiculitis and orchitis. In guinea pigs which are inoculated with *Brucella abortus*, orchitis is a common result. Three of our male patients were first examined by genitourinary surgeons who found clinical evidence of seminal vesiculitis, prostatitis, epididymitis and orchitis. All three denied exposure to gonococcal infection and repeated smears made from urethral discharges after prostatic massage revealed no gram-negative diplococci. The sera of

the three men was found to agglutinate *Brucella abortus* in dilutions from 1:160 to 1:640. Furthermore, the organism was recovered in one case from a draining sinus tract which extended from the globus major of the epididymis through the scrotal wall. Two of these patients were constant consumers of raw milk; the third drank raw milk occasionally and used unpasteurized country butter at his home.

The causative organism derives its name (*Brucella abortus* or organism of contagious abortion) from its etiologic association with abortion in cattle and other domestic animals. It seems reasonable to expect that the organism might have a similar affect on pregnant women. The literature contains a number of reports of human abortions occurring on farms where the cattle were affected with contagious abortion. We have encountered 5 cases in which women who have repeatedly aborted and who presented no clinical or serological evidence of syphilis gave serological evidence of previous infection with *Brucella abortus*. In these cases the agglutinin titers ranged from 1:80 to 1:320. Four of the 5 women gave histories of a previous febrile illness, the nature of which had not been determined, at intervals from three to six years previously. All had been raw milk consumers. Carpenter[17] has recently isolated *Brucella abortus* from human fetal tissues in a case of abortion. *Brucella abortus* has been isolated from a tubo-ovarian abscess which developed as a late complication in a case of known undulant fever. These findings open a new field of investigation in cases of human abortion.

A *skin eruption* occurs in about 5 per cent of cases, usually taking the form of red macular scaling lesions. These may appear on the abdomen and simulate the roseola of typhoid fever. To further confuse the disease with typhoid fever the spleen is frequently enlarged, palpable splenomegaly having occurred in about one-third of our cases.

The clinical blood findings are of the greatest importance. A mild secondary anemia is a common finding. The red blood cells average about 4 million per cubic millimeter and the hemoglobin varies from 60 to 80 per cent. Even though the fever may be high, *leucocytosis is uncommon*. Leucopenia (4000 to 6000) with lymphocytosis occurred in three-fourths of our cases during the acute phase of the disease. The remainder showed a normal differential count or slight leucocytosis. In only 2 cases did the white cell count exceed 10,000. The lymphocytosis may exceed 50 to 60 per cent.

Urinalysis usually reveals small amounts of albumin.

One death occurred in the Dayton series. Ten fatalities have been recorded in American literature. Based upon the figures derived from the literature the death rate is approximately 2 per cent.

DIAGNOSIS

Perhaps the most important diagnostic consideration is to include undulant fever in the differential diagnosis of all cases of protracted febrile illness. There are three ways in which the clinical diagnosis may be confirmed: (1) the recovery of the organism from the blood or urine; (2) agglutination test; (3) skin test. The simplest method is to submit 4 or 5 c.c. of the patient's blood, collected exactly as for the Wassermann test, to a laboratory that is equipped with the proper *Brucella abortus* and *Brucella melitensis* antigens. It is unlikely that agglutinins develop during the first week. Therefore, the blood should be collected sometime during the second week of illness. Dried blood specimens on slides are unsatisfactory. In most cases, agglutination will occur in dilutions of 1:160 to 1:1280 during the third or fourth week of illness. In some instances the agglutinin titer will rise to great heights; positive agglutination in a dilutions of 1:20,480 was obtained in 1 of our cases during the fourth week of illness. In many cases the agglutinins persist in the serum for many years after apparent

recovery, while in other cases the agglutinins entirely disappear a few weeks or months after recovery.

It is important to bear in mind that the presence of anti-*abortus* agglutinins in low titer does not necessarily mean that the individual is suffering from undulant fever at the time of the test. The individual may be suffering from some other disease and the simultaneous presence of anti-*abortus* agglutinins may represent merely the residual titer of a previous attack of undulant fever.

For practical purposes we have considered that agglutination in titers of 1:80 or above, or the recovery of the organism from the blood or urine, constitutes positive evidence of the existence of undulant fever. However, there are occasional cases in which the clinical picture of the disease is well defined and in which agglutination occurs in titers of 1:10 to 1:40. In such cases further bacteriological and serological studies should be carried out.

Carpenter and Evans have recorded cases in which *Brucella abortus* has been isolated from the blood of individuals suffering from a febrile illness, whose sera showed no anti-*abortus* agglutinins. It would appear that there is need for a more delicate test to supplement the agglutination test. The intradermal test, utilizing suspensions of killed organisms, appears to hold considerable promise as a diagnostic aid. In 10 of the Dayton cases in which anti-*abortus* agglutinins were present in titers ranging from 1:320 to 1:1280 positive skin tests were obtained after the intradermal injection of 0.1 c.c. of a suspension of killed *abortus* organisms. Giordano[17] has obtained uniformly successful results with the intradermal test.

TREATMENT

Perhaps the most important phase of the treatment is prophylaxis. Complete pasteurization of milk destroys the organism and would be the logical means for eliminating milk-borne infection.

The treatment is essentially symptomatic. Strict confinement to bed is a most important measure in the most serious cases. Mercrurochrome has been given intravenously to 23 patients. In 16 cases its affect has been regarded as favorable, while in the other cases it has had no appreciable affect upon the course of the disease. Acriflavin has been of doubtful benefit in a few cases.

In 26 of the Dayton cases we have utilized a vaccine made of killed *abortus* organisms (two billion per cubic centimeter) with apparently favorable results. Further investigations of the efficacy of this vaccine will be carried out before any definite conclusions are reached.

SUMMARY AND CONCLUSIONS

1. Undulant fever has rapidly become a most important public health problem. Over 1000 cases have been discovered in this country during the past few years.

2. Seventy-two cases have been discovered in and about Dayton, Ohio, during the past one and one-half years.

3. Undulant fever possesses important surgical aspects, chiefly because of the ease with which it may be confused with appendicitis and cholecystitis in certain cases. In view of the predilection of the organism for the genital tract it bears an etiologic relationship to certain cases of abortion, tubo-ovarian abscess, seminal vesiculitis, prostatitis, epididymitis and orchitis. The joint manifestations of the disease make it a diagnostic problem for the orthopedic surgeon.

4. Contrary to the frequently expressed belief that undulant fever is difficult to recognize clinically, the clinical manifestations of the disease were sufficiently characteristic to enable physicians to make an initial diagnosis of undulant fever in over one-third of our cases.

5. The relationship between the consumption of raw milk from cattle infected with the organism of contagious abortion (*Brucella abortus*) and the occurrence of undulant fever in human beings has been established.

[NOTE: For references see authors' reprints.]

THE PATHOGENESIS OF RENAL TUBERCULOSIS*

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THE investigations upon which this report is based have been fully reported in two articles already published.[1] Renal tuberculosis is a problem of major importance in the field of urology because of the fact that nephrectomy is often resorted to either to allay great suffering experienced by the patient, or because the only demonstrable clinical tuberculosis is restricted to one kidney.

There are two ideas quite prevalent regarding the tubercle bacillus and the kidney which I take exception to. These are the questions of "excretory bacilluria" without tuberculous lesions being in the kidney, and the often made statement that tuberculosis of the kidney never heals.

From all obtainable evidence renal tuberculosis is always a hematogenous infection. This I believe is true whether or not it is possible to demonstrate the primary tuberculous focus clinically. This means that renal tuberculosis is but one manifestation of the general disease tuberculosis. And in some cases the major tuberculous lesion happens to be in the kidney.

From our study of the urine of animals experimentally infected with tubercle bacilli we found no evidence to support the view that the kidney excreted tubercle bacilli without tuberculous lesions of the ulcerative type being present in the organ. We could find tubercle bacilli occasionally in the capillary tufts of the glomeruli, although the urine gave no evidence of their presence. And we found rather large tuberculous lesions in the guinea pig kidney without tubercle bacilli in the urine. When tubercle bacilli were demonstrated in the urine we found ulcerative tuberculous lesions in the kidney. This investigation led us to the conclusion that tubercle bacilli were not excreted by non-infected kidneys, and that the absence of tubercle bacilli in the urine did not rule out the presence of tuberculous lesions in the kidney.[2]

If one adopts the prevalent idea that renal tuberculosis never heals then when one finds tubercle bacilli in the urine it is logical to advise nephrectomy at once. It is now known that tuberculous lesions in the lung, lymph nodes, intestine, bone and other tissues do heal, though the process is always slow. It would seem that if tuberculous lesions in these tissues can heal then certainly some tuberculous lesions of the kidney might heal.

To investigate the question of healing of tuberculous lesions in the kidney we studied very carefully the kidneys in about 30 cases dying of pulmonary tuberculosis. None of these cases had any clinical symptoms referable to renal involvement. And all of the cases had more extensive tuberculosis pathologically in lungs and other tissues than in the kidneys.

This study purposely left out cases of renal phthisis, that is, those cases in which there was extensive involvement of the kidney tissues with resultant cavity formation in these organs. In other words, we studied the early and the small tuberculous lesions rather than the large and late lesions. It is practically impossible to demonstrate the point of origin and the subsequent development of any tuberculous lesion after it has attained the

[1] Medlar, E. M. *Am. Rev. Tuberc.*, 10: 370, 1924; *Am. J. Path.*, 2: 401, 1926.

[2] For technique used in this investigation cf. *Am. Rev. Tuberc.*, 10: 370, 1924.

* Read before the Section of Genito-Urinary Surgery, New York Academy of Medicine, March 20, 1929.

stage where it involves considerable renal tissue. And it was our desire to determine the sequence of events that occurred in the kidney before the tuberculous process reached the stage commonly called surgical tuberculosis.

From this study we came to the following conclusions: The kidneys are commonly involved in cases dying from pulmonary tuberculosis. The renal lesions are hematogenous in origin. Usually both kidneys are involved. One kidney may be more extensively involved than the other. The majority of the tuberculous lesions arise in the glomeruli or in the tissues between the tubules in the cortex. An occasional lesion was found limited to the papilla and an occasional lesion, apparently arising in the arcuate zone and involving both cortex and pyramid, was observed.

Scars were demonstrated in a considerable proportion of those kidneys in which definite tuberculous lesions were also present. We believe these represent healed tuberculous lesions, although there was nothing pathognomonic of their having been tuberculous in nature. The kidneys showed tuberculous lesions in various stages of development which we interpret as evidence that there had been several "showers" of tubercle bacilli which infected the kidneys at different dates. If one admits that some of these lesions represent healed tuberculous foci, then the commonly accepted belief that tuberculous lesions of the kidney never heal is no longer tenable.

I am not of the opinion that a kidney with a large tuberculous lesion will completely heal. That it may become less active and regress in its progressive character I believe is possible.

[For discussion of this article see p. 616.

DIAGNOSIS & TREATMENT OF CHRONIC RENAL TUBERCULOSIS*

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THIS subject is one of great interest and of vast importance. I personally have been studying the problems related to the pathology, diagnosis and treatment of chronic renal tuberculosis for more than a quarter of a century, and in preparing this paper, I have gathered together the experience gained during these last thirty years. I have reviewed my records of the last fifteen years with considerable care and used the data gathered in over 300 cases.

The recognition of tuberculosis of the kidney as a surgical condition has been a development of comparative recent years. Under the influence of some of the leaders of French urology, the surgical treatment of renal tuberculosis was somewhat delayed, but at the present time chronic surgical tuberculosis limited to one kidney is universally considered as belonging in the realm of surgical therapeutic endeavor.

With the development of the cystoscope and the more accurate methods of diagnosis connected therewith, together with the accumulated experience of clinical observation of excellent results following nephrectomy, this disease has become recognized as definitely belonging in the field of the surgeon's activity.

Although the clinical picture of the disease is varied, still in a vast majority of cases, the picture is so nearly the same that the general practitioner ought to suspect it and make a correct diagnosis. In the more unusual clinical courses, it is often difficult for the general practitioner even to suspect the underlying condition. In the determination of the exact urological condition, the urologist, naturally, has to be called in to decide whether the kidneys are not to be incriminated and the genital tract is responsible. In females the situation, naturally, is much simpler as the genital tract rarely complicates the urinary picture.

With the development of renal tuberculosis, the most characteristic symptoms are referable to the bladder. In the majority of cases urgency, frequency, burning at the neck of the bladder or in the urethra during micturition, pyuria with or without microscopic or macroscopic hematuria, are the outstanding symptoms. Urotropine, which is usually administered to relieve bladder symptoms, rarely helps and usually irritates the bladder. Bladder irrigations also rarely help. If there is any improvement it is usually transitory. Such patients are usually treated for months as subacute or chronic cystitis cases, and only when the physician fails to get a definite result after months of therapeutic effort, does he refer the patient to a more competent diagnostician. This should scarcely be necessary as every persistent pyuria deserves cultural study, including a search for tubercle bacilli in the smear as well as guinea-pig inoculation if the catheterized urine is found to be sterile.

A great many patients are seen with this symptom-complex who have been treated for months or even a year or more without any accurate diagnosis as to the cause of the trouble, while such simple procedures as those just mentioned would immediately clarify the etiology. Every practitioner should be on the lookout when patients have pyuria and persistent irritation of the bladder, especially in women and men between the ages of twenty and forty, when tuberculosis of the kidney is most common, though both

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From the Surgical Service of Mount Sinai Hospital.

before and after these two decades the disease is not infrequent.

Some of the patients with renal tuberculosis present quite a different picture and simulate nephrolithiasis. They have pain in the kidney, more or less colicky in character, sometimes associated with attacks of bleeding. In these patients the irritation of the bladder at first may be fairly marked and then subside. As roentgen-ray examination in some of these patients may show definite shadows of more or less porous-looking calculi in the kidney region, the diagnosis of renal stone may be erroneously made. This type of case will probably rarely be recognized by the general practitioner and requires frequently the most careful urological and radiographic study.

The third type of patient presents himself with a history which suggests either essential hematuria or renal neoplasm. There is massive bleeding associated with more or less distress or colicky pains corresponding to the ureter, and the hematuria may be so marked as to lead to clotting in the bladder or threaten exsanguination. In this type of case again, the practitioner will usually be at a loss and require the assistance of a urologist.

The fourth type that I have seen is perhaps one of the most confusing of all. In a small percentage of the cases that have come under my observation, instead of the usual bladder irritation, there are no signs of frequency or urgency, the patients have a pyuria which is apparently not explicable, and have no renal symptoms to suggest that a serious pathological condition is present.

A fifth variant in the clinical picture is presented by a considerable group of patients who begin as the first and common type with all the usual signs of vesical irritation and these gradually subside, apparently due to either the therapeutic efforts or to nature's activities. In these patients the kidney has become excluded from the bladder by stricture formation in the ureter, usually at the bladder orifice or close to it, and as the tuberculous urine no longer is poured into the bladder, the irritative phenomena cease and the urine becomes clear. Unless the proper studies have been made during the stage of pyuria, without the urologist diagnosis will be impossible.

A sixth very puzzling picture is presented by those rare cases that simulate subacute or acute pyelonephritis. Even the urologist will have difficulty in recognizing these unusual cases. Whether they are always cases with superadded mixed infections, I have not as yet been able to determine.

A seventh type presents itself as a perinephric suppuration and the suspicion of tuberculosis may not be entertained until the persistent sinus following the drainage operation, demands a nephrectomy and the kidney presents all the ear-marks of the pathology of renal tuberculosis.

The family history and the past history of the patient will occasionally suggest to the practitioner the possibility of a tuberculosis being present in the urinary tract. If there is a definite family history, or the patient has had attacks of pleurisy or pulmonary tuberculosis, involvement of joints or spine, cervical adenitis, chronic epididymitis, and the like, the suspicion that the persistent pyuria is tuberculous will naturally be aroused; and if the practitioner bears in mind the more frequent typical courses that renal tuberculosis runs, with moderate laboratory help, he should readily be able to turn over the patient to the urologist with the definite statement that this patient has a urogenital tuberculosis (if it be a male), or urinary tuberculosis (if it be a female). To this goal, we have not arrived as yet.

The general health of these patients rarely suffers unless mixed infection with chills and fever develop. They may lose in weight because of the nocturia which interferes with sleep, but as long as the disease is unilateral and no massive hema-

turias have taken place, it is surprising how well they stand their incompetent medical attention. When the disease is bilateral, unfortunately in 10 to 20 per cent of the cases, lassitude, anorexia, loss of weight, pallor, disturbed renal excretion and disturbed proteid metabolism develop, and the patients become suburemic or uremic. Gradually they go downhill and die, within a year or two of the inception of the bilateral involvement, of renal insufficiency, pulmonary tuberculosis or miliary tuberculosis.

Most patients come to our offices more or less disgusted with the treatment that they have had, and give us one of the typical histories briefly sketched above. Physical examination of the kidney is of little value. The involved kidney may be enlarged, at times very large especially if excluded and hydronephrotic or pyonephrotic. At times, the other kidney which is healthy seems the larger. Tenderness may be present but usually is negligible. Vaginal or rectal examination may allow of palpation of the thickened rigid ureter which is of real diagnostic import. With the aid of cystoscopy and ureteral catheterization, the definite diagnosis is made in the majority of cases in one examination. The proof that tuberculosis is present demands the finding of the bacillus of tuberculosis; but, on the other hand, a definite knowledge of the picture induced in the bladder by tuberculosis of the kidney is frequently sufficient to establish the diagnosis even in the absence of a positive smear or guinea pig test. Many patients that cannot be examined repeatedly, owing to the condition of the bladder, have their diagnoses established by the competent cystoscopist who locates the side of the disease and makes certain that the second kidney is not involved. Although cystoscopy can usually be performed under local anesthesia, in some cases the bladders are so sensitive, owing to ulcerations and contraction of the lumen, that caudal, spinal or gas and oxygen may be necessary.

The cystoscopic picture of the secondary cystitis caused by the renal tuberculosis is quite varied and rather difficult to describe as many pathological lesions are liable to be present at the time of examination. In the earlier cases there is rarely more than a hyperemia with or without a slight rigidity of the lips of the ureteral orifice. As the disease progresses, the adjacent mucous membrane becomes involved, mottled with small hemorrhagic spots, and the ureteral orifice becomes more rigid and edematous. At times the edema becomes even polypoid suggesting papilloma. Tubercles develop in the mucosa as little whitish-yellow spots surrounded by a hyperemic base; some of these break down and sharply cut-out, irregular shaped ulcers varying in size develop in the mucous membrane. If these ulcers are of any size, their edges overhang just as in tuberculous ulcers on the mucous membrane of other organs. With the development of ureteritis, there is a distinct shortening of the ureter and the bladder is drawn up towards the kidney so that the ureter region becomes retracted. Many of these ureters become patulous, so-called golf-holed, owing to the extensive scar tissue formation in the wall of the ureter. Some bladders become infected with other germs, and as a result of the mixed infection, exudate forms, becomes attached to the ulcerated areas, and granulation tissue frequently develops in the ulcer base. As this process develops, more and more of the bladder becomes involved, and as a result, the bladder becomes contracted and its capacity very much diminished.

These lesions are always, in my experience, most marked at the ureteral orifice on the side of the renal tuberculosis. Occasionally there may be a smaller but much less extensive process at the second ureteral orifice even though the second kidney is apparently perfectly normal. I have never seen a picture such as Rovsing called attention to, in which the ureteral orifice on the normal side presented the evidence of the disease

and the ureteral orifice of the diseased side was absolutely or almost normal. Wildbolz[1] has raised the question as to the site of the ulcers and claims that they are very frequently in the anterior bladder wall. In cases that I have studied, I cannot agree with this as ulcerations have usually been on the base of the bladder, usually most marked in and about the diseased ureter, although I have repeatedly seen them in the anterior wall as well. In females, occasionally ulcerations extend into the urethra and, at times, may even reach the external meatus. In the rarest cases, caseous masses develop in the bladder wall. These masses, in one case that has come under my observation, were all of sufficient size to suggest large multiple conglomerate tubercles, being 1 cm. or more in diameter and raised well above the adjacent mucous membrane.

On distending these bladders while performing the cystoscopy, one is liable to induce bleeding owing to the damage to one of the ulcerated surfaces. In early cases, cystoscopy and ureteral catheterization is usually perfectly feasible, but in advanced cases, one may have a great deal of trouble in passing the ureter catheter up the ureter of the diseased side though the healthy side may be very readily catheterized. This is due to the well-recognized tendency of strictures to form in the tuberculous ureter which prevents the ready introduction of the catheter even though a small amount of purulent infected urine enters through the stricture into the bladder. These stricture formations may be so extensive as to lead to complete exclusion of the involved organ, so-called autonephrectomy, and many a patient who has had this pathological change has been relieved of the vesical irritation and apparently got well spontaneously. A number of such patients that I have seen have subsequently come in for tuberculosis of the second previously healthy organ, the first having been excluded years before by this stricture formation within the ureter.

The use of indigo-carmine (intravenous or intramuscular) is of great assistance not only in determining the function of the two kidneys but also in locating the orifices in badly diseased bladders. In early renal tuberculosis there may be no delay in the excretion as compared with the second healthy kidney and the concentration may also be unchanged. As the disease progresses both the concentration of the dye diminishes and the time of excretion is delayed. In early cases the urea concentration may behave in the same way. As the tuberculous kidney usually secretes an unusual amount of urine, polyuria, the dilutions are readily understood and in part explained.

As previously stated, the cystoscopist must try to base his diagnosis on absolute data, and these data are pyuria and the tubercle bacillus in the specimen collected from the diseased kidney by the ureter catheter. A sterile pyuria may occur in stone kidney though it is comparatively rare. It usually means tuberculosis. This finding is encouraging but not of absolute value. In my experience the finding of the Koch bacillus in the smear (using the third test-tube) is the best evidence of renal involvement. It has proved even more reliable than the guinea-pig inoculation even though the latter is a more sensitive test. In 18 per cent of the examined healthy second kidneys, we have found the pig positive (corroborated by Brassch[2]) which has led some years ago to our studying the significance of tubercle bacilli in the catheterized kidney specimens.[3]

In connection with this study, we were fortunate to have had the benefit of Tilden-Brown's ingenuity in perfecting the cystoscope which separates the catheterizing system from the irrigating. The European instruments with the catheters in the cystoscope's channel-wall is much less satisfactory for careful diagnostic work incidental to the recognition of renal tuberculosis, as, owing to its construction, contamination of ureter specimens is much more likely. The technique in cystoscopy

work in the examination of these patients has to do most rigidly careful so as to avoid getting questionable data on which to base the diagnosis. Contamination of specimens either in transit through the bladder or by reflux up the ureter must be avoided by plugging the catheters externally and by collecting specimens with the bladder empty, and by using only late collections for smears and pig inoculations. About twelve years ago I called attention to all those points, but I fear they have not been fully appreciated by the profession as yet. I note, however, that Wildbolz and Braasch have encountered the same difficulties and have emphasized their importance in the diagnosis of unilateral renal tuberculosis as opposed to bilateral renal tuberculosis, as well as renal tuberculosis as opposed to genital tuberculosis, and also urogenital tuberculosis as opposed to excretory tubercle bacilluria.

If the cystoscopist employs the above precautions and is able to pass a catheter up the diseased side, pyuria and tubercle bacilli almost invariably mean renal tuberculosis of that kidney.[4] In those cases in which the catheters cannot be introduced far enough to get a series of satisfactory specimens, one often must rely on the characteristic bladder picture, the recognition of the strictured ureter and upon finding the tubercle bacilli in the bladder urine while the specimen from the second kidney shows no pyuria and no tubercle bacilli. Complications in the situation arise when the second kidney is not definitely tuberculous and the bladder is badly and diffusely diseased with secondary involvement of the lower end of the second ureter which one has difficulty in catheterizing well up to the pelvis. In a fair number of cases the second healthy kidney may show evidence of toxic nephritis, albumin and casts which usually disappear following nephrectomy of the diseased side.

In males, prostatic tuberculosis may lead to a clinical picture quite similar to the cystitis of renal tuberculosis, and as a fair percentage of these patients, perhaps 15 per cent (Cunningham), may have tubercle bacilli in the bladder urine, one must be on guard against contamination of the collected specimens from this source. Unfortunately, in the study of excretory bacilluria, the investigators have usually failed to consider this possibility. Recently Bumpus[5] has rather rashly stated that tubercle bacilli in the urine is synonymous with renal tuberculosis. In the study of excretory bacilluria, in the future, it would be well to bear this point in mind and make the studies in female pulmonary cases only so as to avoid any such possible contaminations as may occur in the male genitourinary tract. Calmette believes that one must inoculate at least 10 tubercle bacilli into a pig to produce tuberculosis, and others claim that many thousands per cubic centimeter must be present before they can be found in the smear. Almost all the cases of excretory bacilluria have been checked by the pig-test in its various modifications, the smear being regularly negative. Recently enthusiastic reports on cultural identification have been published both abroad and here. Perhaps in the future these newer methods may be found of practical use in our clinical work.

As one peruses the literature carefully, one encounters cases such as Wildbolz[6] reported last year at the Urological Society meeting in Chicago. In his case he had positive guinea-pig tests on both kidneys, and subsequently removed the kidney that had definite pyuria. The patient was cured, and subsequently inoculations were negative. I have reported, years ago, repeated bilateral positive inoculations in prostatic and in unilateral renal tuberculosis, and the subsequent course of the cases showed that we were getting these confusing results, either because of gross contamination of the catheters, reflux up the healthy side or sides, or perhaps as a result of excretory bacilluria. I have collected from the literature a number of

such cases in which the authors, failing to appreciate these phenomena, have claimed a cure of a tuberculous second kidney by removal of the more diseased mate.

Tubercle bacilli are so characteristic that they can rarely be mistaken for anything else, and obtained from catheterized specimens, gathered with ordinary care, there is little if any danger of confusing them with the smegma bacillus. We have found them in the smear in the last series of 100 operated cases of proved renal tuberculosis in 89 per cent of the cases.[7] The most difficult cases in which to find them are the old very chronic cases where urine is full of pus. Here the antiformin method on large quantities of urine may be necessary. The carbol-fuschin stain with thorough decolorization in acidified alcohol is usually sufficient to demonstrate the bacilli. Many cases have shown the bacilli in smear and, nevertheless, the pig had failed to develop tuberculosis. We usually stain not only the kidney specimen but also the bladder specimen so as to have a control. We also inject the urine into guinea pigs in many doubtful cases so as to make doubly sure. If the bladder urine in the pig is positive, the patient is sent for and reexamined. It is surprising how seldom we have found that we have missed the renal tuberculosis as determined by this control. Since this technique has been carefully adhered to, we have made much less use of activating doses of tuberculin,[8] though every once in a while we have been compelled for safety-sake to resort to this technic when renal tuberculosis seemed likely to be present and no cystoscopic and urinary evidence was manifest. It is well known that tuberculin, although not absolutely innocuous, leads to the throwing off of showers of bacilli, and every once in a while this effect has been noted on my service. In those rare cases of intra-renal exclusion of a tuberculous focus in which the symptoms of vesical irritation and pyuria are temporarily relieved, these activating doses of tuberculin will probably be of great use.

Before leaving the subject of diagnosis, a word must be said about radiographic evidence of renal tuberculosis. Whether calcification is a sign of healing or not, it is sufficiently often present to be recognizable in roentgen-ray films, either as irregular plaques of opaque material or as porous calcified areas somewhat resembling stones. These calcified areas may outline calices, pelvis or ureter, and in some of the excluded putty kidneys, there is sufficient calcium to throw a definite lobulated shadow representing the enlarged kidney.

Cystography has been thought to be of some use especially if it shows fixation and deformation in and about the position of the diseased ureter. At best it seems only corroborative, other evidence of the disease being infinitely more valuable. If the diagnosis can be made without pyelography, I feel this added trauma should not be inflicted upon the patient. Recently Kearns reported that in 7 cases that he knew of, 5 died within one to two years of generalization of the tuberculosis following pyelography. Occasionally it may be required and it will frequently show the pathological changes very vividly, one or more strictures in the ureter with more or less dilatation between, more or less hydronephrosis with excavation of one or more calices which looked ragged and worm-eaten. Unfortunately, occasionally one sees pictures of caliceal disease caused by non-tuberculous disease, simulating the above, so that one is in doubt except in the more advanced cases of the exact interpretation of the pyelogram.

Despite all the above refinements in diagnostic measures, one is occasionally forced to make an exploratory operation to decide whether one or both kidneys are tuberculous. This is much less frequent than it used to be. On exposing the suspected kidney, one can usually see some changes in the cortex after stripping the capsule, or one can palpate the thickened firm ureter which usually clinches the

diagnosis. Some have recommended collecting specimens from the exposed kidney by ureterotomy and staining them immediately, but that seems unlikely to gain many adherents. If the ureter is soft and normal, the kidney cortex is negative, and the pelvis normal to palpation, it is highly doubtful whether that particular organ is tuberculous and so badly diseased as to have prevented a trained urologist from getting a cystoscopic specimen. In one case that I was in doubt about, I incised a suspicious area, saw the typical changes in one papilla, closed the kidney and removed it without any damage to the patient and without infecting the wound. In several doubtful cases, I have split the suspected organ, explored the whole pelvis under rubber tube hemostasis, and finding no evidence of tuberculosis, have resutured the organ and preserved a very adequate kidney. One such case with pole to pole section and resuture should only a moderate disturbance in functional capacity.

The treatment of chronic unilateral renal tuberculosis by nephrectomy has been placed upon an unassailable foundation during the past thirty years. Surgery has built this foundation, and I thoroughly believe it is a really great achievement. When there was doubt as to the frequency of the incidence of unilateral involvement, naturally there were sceptics who preferred to use other therapeutic measures. Rafin collected data on 669 cases of renal tuberculosis that came to autopsy, and 348 cases (or 52 per cent) in the end-stages were still unilateral. Clinical studies with careful methods have demonstrated in various competent hands that somewhere between 10 per cent and 20 per cent come to the surgeon for relief of symptoms with bilateral disease, and that between 80 per cent and 90 per cent have involvement of but one kidney at this period. The excellent results of nephrectomy in the latter group (which were recently reported by Wildbolz) prove conclusively that in the vast majority of cases the disease begins in one kidney. In re-studying a series of 270 cases nephrectomized more than ten years ago, he found 59 per cent alive and all but 3 cases absolutely well. This corresponds fairly accurately with the experience in all large clinics, though it must be emphasized that patients so placed that they can take good care of themselves have a better chance than those less fortunate economically.

Another viewpoint is obtained by studying the end-results of cases not treated by nephrectomy. As yet, no careful observer has reported a definite case of chronic renal tuberculosis that was cured spontaneously or by tuberculin, heliotherapy and hygiene. Apparent cures by ureteral occlusions, or temporary cures by caliceal occlusions, may occur but the tuberculosis is still present and usually flares up on the slightest provocation. In those cases of so-called bilateral involvement in which the more diseased kidney had been removed and the second kidney had apparently spontaneously improved, the above diagnostic analysis has very definitely invalidated the evidence on which the bilateral involvement has been diagnosticated. Moreover, all definitely proven cases of bilateral disease usually die within the first two years. Israel found 70 per cent of 62 such cases, in whom one kidney had been removed, died shortly after the nephrectomy.

There can be no doubt that the more carefully one works, the more bilateral cases will be discovered before one decides on nephrectomy. Perhaps we are justified in believing that a fair proportion of the patients that die of involvement of the second kidney with tuberculosis during the first two years following removal of the evidently tuberculous kidney may have had bilateral involvement at the time of the nephrectomy. This, however, would be a rash conclusion as we have no definite evidence bearing on this point. The tendency to believe that the disease is usually bilateral in adults because it is hematogenous in origin, is equally illogical as we all know that staphy-

lococcus aureus embolic abscesses of the kidney are hematogenous in origin but almost always unilateral. Personally, in well over 80 cortical abscess cases, I have seen only 4 bilateral cases. In children, on the other hand, unfortunately the tuberculous disease is more frequently bilateral, probably in part owing to their ineffectual general and local resistance and to the fact that it is part of an acute or subacute miliary tuberculosis. In adults with equally diminished resistance, a bilateral involvement develops under the same conditions but here, as in children, the disease is scattered through the kidney with cortical predilection, whereas in the typical unilateral chronic cases, in the earliest stages the disease is almost invariably limited to the medulla, involving papillae and calices before extending to the cortex and pelvis.

Though nephrectomy is absolutely indicated in all unilateral cases provided the second kidney is functionally adequate, which is almost always the case, there is still some discussion as to whether any operation should be carried out in definitely proven bilateral cases. Rarely do indications present for such operative interference, and experience has shown that only in the exceptional case is benefit derived. Chills and fever due to a mixed infection, secondary perinephric abscesses, repeated hemorrhages, painful colics caused by stones, may force the surgeon to interfere actively, not with the hope of curing but with the expectation of bringing some relief. My experience has shown that expectations are usually not fulfilled.

Nephrectomy with removal of the upper ureter is the operation of choice in chronic renal tuberculosis. If, however, the ureter is badly stenosed and dilated above the stricture, I believe, an aseptic nephroureterectomy through two incisions, the lumbar for the kidney and a pararectus extraperitoneal for the lower ureter, bringing out kidney and attached unopened ureter through the lumbar wound[9] is the operation of choice. It does not prolong the operation and at the same time prevents any secondary empyemata of the ureter or ureteral fistula.

The operation must be done with gentleness as otherwise one may squeeze tubercle bacilli into the circulation and perhaps induce a fatal miliary tuberculosis. In at least 3 cases, I have found that such a bacillemia followed the operation as proven by guinea pig inoculations of preoperative and postoperative blood.

As yet, no method has been devised to prevent more or less extensive wound infection and delayed healing of the nephrectomy wounds. Sinuses or tuberculosis of the whole wound are liable to be present in almost 25 per cent to 30 per cent of the cases and they are notoriously slow in healing. Their causation is in dispute. Most writers attribute them to the diseased ureter. This is surely a mistake as I find they occur about as frequently in the cases in which I remove the whole ureter as in those in which I remove only an inch or two. Others believe they are due to tuberculosis in the fat about the kidney, which Legueu has claimed to be a common occurrence. In the innumerable pieces of fat that I have removed for such control examinations, microscopic tubercles have rarely been found. In some cases the wound infection is undoubtedly due to gross spilling, but even this is not regularly followed by a long persistent disturbance in the healing.

Further study of this whole subject has firmly convinced me that the explanation is to be found in the traumatic bacillemia induced by the operator. As a result of this, the tubercle bacilli arrive in the vascular muscular wound and induce here and in the deeper tissue a secondary tuberculosis. In the cases in which I have performed a complete ureterectomy, the so-called aseptic nephroureterectomy, the anterior rectus sheath is absolutely avascular, no vessel being cut or tied, and this wound never becomes infected but closes by primary union though the diseased stump of the ureter is at its bottom, whereas the posterior vascular

muscle incision in about one-third of the cases, fails to heal kindly. This corroborative experience is experimental proof of the correctness of my explanation of the origin or causation of most of these sinuses or wound tuberculosis.[10]

Whether this traumatic bacillemia is responsible for the involvement of the second kidney, which if it is going to develop seems to show itself most frequently during the first few years, one can not say. Israel suggested a selective affinity of renal-fed bacilli for renal tissue, much as others have more recently attributed this faculty to streptococci. This possibility must be borne in mind in trying to decide the question previously discussed, namely, are those cases of early involvement of the second kidney following nephrectomy due to oversight or to new fresh tuberculosis, possibly secondary to the traumatic bacillemia induced by the nephrectomy.

After removal of the diseased kidney, unfortunately the patient is still a patient and must be carefully protected from harmful influences. Good food, rest, hygienic surroundings are essential, even if there are no actual tuberculous foci that require therapeutic attention.

A very fair proportion of the early cases require no more than careful supervision. They feel fine and have no symptons and are liable to neglect themselves. Others have persistent bladder symptoms and may require local applications or irrigations in addition to general hygienic measures. The tuberculous cystitis with its ulcers is particularly stubborn, and though we have had best results with high frequency cauterization or electrocoagulation, still at times the result is only transitory and reapplications of the current are necessary. Irrigations and topical applications, as well as instillations of various bacilli, have been tried with varying results. Carbolic acid still has some friends. Superficial x-ray and Alpine light occasionally seem beneficial. Usually, one has to try one method after the other, one drug after the other, so that one is in doubt as to what has benefited. The electrocoagulation of the surface of these tuberculous ulcers seems to give immediate relief, and though it may require gas-oxygen anesthesia to make such applications possible, the result is well worth the while.

Despite all our efforts to date, the nephrectomized tuberculous patient has a definitely lower life expectancy than most patients with single kidneys. Not only is there a 10 per cent to 20 per cent chance of later tuberculous involvement of the second organ but miliary tuberculosis and pulmonary tuberculosis are most serious dangers that these patients face.

Before closing this too sketchy paper on a most important subject, let me consider the possible contraindication to nephrectomy in solitary renal tuberculosis. Open active pulmonary tuberculosis with fever may be present, and if the renal symptoms are not severe and distressing, a kidney operation may be deferred. If, however, the dysuria and frequency are interfering with the patient's ability to cope with the serious pulmonary lesion, the kidney will have to be sacrificed using spinal anesthesia. One should also be wary of operation on patients without mixed infections who are running an up and down septic temperature, lest one add insult to injury and remove a kidney from a patient who is suffering, as well, from a subacute or acute miliary tuberculosis.

In this review I have attempted to bring altogether all the highlights or essential points as briefly as possible. I realize very thoroughly, having followed the literature of this subject most carefully, that it is impossible to touch on all the minor details of diagnosis and therapy that a longer paper would permit.

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DISCUSSION OF PAPERS BY DRS. MEDLAR AND BEER

Dr. O. S. Lowsley: Dr. Beer has called our attention to many facts which some of us may have neglected, and I am certainly encouraged to more enthusiasm about staining slides of suspected tuberculous urine by the fact that he and his associates have had 89 per cent positive smears. That is most remarkable. It indicates that we should attempt the method more than we have in the past.

Dr. Medlar has proved quite beyond question that tuberculous lesions can heal. We have all seen many interesting cases in which we have been surprised and delighted with the results. I would like to cite my experience with a young girl who came to me about eight years ago with bilateral tuberculosis, both kidneys apparently considerably involved, and function diminished about equally on both sides. She was placed under the best hygienic conditions of fresh air, sunlight, food, and rest in bed each day, and since that time she has married and has had two children without any apparent serious set back in her general condition, although I have not cystoscoped her since the birth of her last baby. She is now asking permission to have a third baby.

Dr. Beer mentioned a fact about which we feel very strongly: that any case who has been operated on is to be considered an arrested, not a cured case. We borrowed that term from those who deal with pulmonary tuberculosis, and we can well use it. We have established a clinic where inoperable cases are treated, running parallel series of those who are receiving tuberculin, rest cure, and those cases which receive this hygienic treatment without tuberculin. Thus far we have not enough cases to determine which is the most satisfactory method; but under these measures certain cases have improved remarkably. We refer to this clinic every case of genital or urinary tuberculosis that we have operated upon.

Dr. H. Dawson Furniss: I was particularly impressed with the stress that Dr. Beer laid upon his advice to the general practitioner to ever be on the look-out for urinary tuberculosis. The general practitioner should be able to make a diagnosis of urinary tuberculosis (with the aid of the laboratory) in at least 85 per cent of the cases. My work is entirely with women, and in them the presence of tubercle bacilli means that at least one kidney is involved, except, possibly, in the rare instances where tubercle bacilli are passed by an uninvolved kidney; in the presence of symptoms, pus and blood, there is practically no doubt of renal tuberculosis being present.

Except in the earliest cases, the diagnosis of the involved kidney can be made from the cystoscopic appearance of the ureter; this may be further substantiated by the delayed indigocarmine excretion; and the indurated ureter may be felt bimanually. In the female, I am against catheterizing a ureter that we know to be tuberculous, as it gives us little additional information, and often stirs up unnecessary trouble. The supposedly healthy side should be catheterized to prove that it is not affected.

In the bladders that are so involved that a successful cystoscopy is impossible, the determination of the involved side or sides can usually be reached by a bimanual examination, as the ureter can nearly always be detected as thickened cord if tuberculosis has existed for any length of time.

Feeling that there is a possibility of the spontaneous cure of renal tuberculosis, I am against removing a kidney just because tubercle bacilli have been found coming from it, and am limiting this operation to the patients who are having much vesical discomfort, and in those where there is pus and blood from the kidney and evidence that the kidney is functionally damaged.

Dr. N. P. Rathbun: I think Dr. Medlar has made a very important contribution and has proved conclusively that small tuberculous

lesions do heal. At the same time, this contribution carries certain dangers with it. I am afraid that some general practitioners may try to treat many cases of renal tuberculosis that should be sent to the surgeon. It seems to me that Dr. Medlar is dealing with a different type of case than those which come to the surgeon. Many of them had no symptoms referable to the urinary tract; when they have definite symptoms with pyuria, and caseous tuberculosis, I doubt if they ever heal.

I do not believe that the finding of a few pus cells (tubercle bacilli) means necessarily immediate nephrectomy. I do not hesitate to make a pyelogram on these cases. I have had no unfortunate results. I believe a pyelogram reveals the degree of destructive lesions of the kidney. I agree with Dr. Furniss that some of the early cases are entitled to observation and some six months in the country under proper hygienic care, followed by a recheck and perhaps operation.

Dr. James Denton: The ideas Dr. Medlar has presented are certainly borne out by what I have seen in the routine examination of pathological material. I admit I have not studied the subject as industriously as Dr. Medlar has. I have been wondering for some time if it is not possible that renal tuberculosis is so often unilateral because of inherent differences in the two kidneys; in other words, the organisms are carried to both kidneys, destructive lesions develop in one and break into the pelvis on account of local conditions, while in the other they remain less destructive. Certainly some of the pictures Dr. Medlar showed demonstrate that the tubercle bacillus can form circumscribed lesions which have but little tendency to spread (involvement of half a glomerulus for example).

I do not think there is any discrepancy between Dr. Medlar's ideas and the clinical ideas that have been presented. Dr. Medlar made it clear at the outset that he was not speaking of clinical tuberculosis of the kidney or tuberculosis of the kidney which had broken into the renal pelvis. Certainly if tuberculosis of other organs is to serve as a guide, as in the liver, spleen and lung, there appears to be no reason why circumscribed lesions in the kidney cannot heal. I think it is very doubtful if tuberculosis which has broken into the pelvis has any chance of healing. I think Dr. Medlar's conclusions are sound.

Dr. Paul Aschner: The work in which Dr. Medlar injects tubercle bacilli intravenously in the experimental animal resembles the dissemination one gets in human beings with acute or subacute miliary tuberculosis. These cases we never consider surgical. In connection with the experiment of injecting tubercle bacilli into rabbits and in which no bacilluria could be demonstrated by inoculating the rabbit's urine into guinea pigs, it may be well to remember that rabbits are susceptible to the bovine type of tubercle and guinea pigs to the human type. I presume that Dr. Medlar was dealing with the human type of tubercle. It is reasonable to suppose that the rabbits which he injected were unlikely to develop it, and therefore his guinea pig inoculations would not show tuberculosis.

Referring to the type of pathological lesion in the experimental animal and the human kidney, we found that the earlier lesions of tuberculosis in man are not in the cortex but in the papillae and the calices in proximity to them. That would seem evidence for excretory origin. Incomplete healing processes unquestionably occur in the human kidney. One kidney which I removed showed a calcified lesion of one papilla, the only lesion present, yet the urinary symptoms were of only one week's duration. The closed-off process had recently ruptured, the symptoms of tuberculosis probably coming on at that moment.

I have operated on only one bilateral case, with pus and tubercle bacilli from both kidneys, collected most carefully. One kidney was pyonephrotic, and that was removed. The patient, though not cured, is much improved five years after operation.

An additional method of diagnosis is to punch out a specimen from a suspected ureter mouth, and occasionally when all other methods fail you will find a typical tubercle in the tissue.

As to the necessity of catheterizing the suspected ureter, it may not be necessary in the female, but in the male where there may be a concomitant prostatic tuberculosis it is absolutely essential to catheterize and get the bacilli directly from the kidney pelvis.

Dr. W. F. McKenna: Dr. Beer very carefully defined his tuberculosis and Dr. Medlar described the early stage, in which the physiology of the animal permitted a cure. That is demonstrated in at least 1 case and possibly 2 others in my experience. One was a female patient with a hematuria on one side and the

tubercle bacillus was recovered from the other side. Assuming that the hematuria was due to a broken-down lesion on one side, it was fair to believe that she had a bilateral tuberculosis. She had lost weight and had temperature. She is now in perfect comfort without other than hygienic treatment with tuberculin for three months.

Dr. A. Hyman: There is no question but that great stimulus has been given to the study of tuberculosis in the past five years, and the good effects are to be noted on observing the different types of tuberculosis that come to the hospital nowadays. The cases in general are not nearly so advanced. Years ago one saw with considerable frequency large tuberculous pyonephroses which had gone unrecognized for a long time. These cases generally required two operations, a nephrotomy and drainage, then a second nephrectomy. This type of tuberculosis is seldom seen at the present time.

The question of excretory bacilluria is an interesting one, and there still seems to be considerable difference of opinion as to whether organisms can be excreted in the urine without showing any definite pathological lesions in the kidney. A number of observers have reported, after careful pathological study, the absence of any lesions, whereas others claim that such lesions (microscopic in nature) are always present and can be found by studying carefully serial sections of the kidney.

There are certain types of tuberculosis complicated by prostatic disease which are very insidious in their onset and cause considerable difficulty in diagnosis. I have in mind a case where the patient was treated for months for a prostatitis, there being no suspicion of tuberculosis entertained. After a few months' treatment, he suddenly developed a hematuria, and cystoscopy showed evidences of a right renal tuberculosis. The question arises in this case whether the prostate is tuberculous or not; and in the absence of positive findings of tubercle bacilli in the prostatic secretion and changes in the gland characteristic of tuberculosis, such a point is difficult to determine.

As regards pyelography, we have seldom found it necessary to resort to it in the diagnosis of tuberculosis. Occasionally, however, in doubtful cases a pyelogram may show changes in a calyx which will be of avail in the diagnosis. In a recent case under observation, one where clear urine was obtained from both kidneys with negative findings for tubercle bacilli, pyelography, by demonstrating a double pelvis, cleared up an otherwise obscure condition.

Dr. Medlar, closing: This review of my work has led to an interesting discussion of divergent views. I would be the last one to say that nephrectomy should never be done in renal tuberculosis, since I am not a surgeon and do not fully know the clinical aspects of this problem. I do feel, however, that great care should be used in selecting the cases to be operated upon. I believe that those cases clinically judged surgical renal tuberculosis have had renal tuberculosis for a long time and consequently there is no immediate urgency for operation. If, in your judgment as surgeons, the removal of one kidney is beneficial, I raise no objection. I would simply urge that because you find tubercle bacilli in the urine you should not hasten to remove the kidney. If the tuberculous lesion is a small early lesion it might regress and heal if given the chance; or it might progress to renal phthisis. That I believe can be determined by a careful following of the case clinically.

The question of bilateral renal tuberculosis is not in any way upset by the failure to find bilateral renal tuberculosis clinically. I showed that you could have tuberculous lesions in the kidney without tubercle bacilli in the urine. These lesions may heal and no evidence clinically will ever be had that they existed. Or they may progress and eventually discharge their contents in the urine, thus demonstrating the presence of renal tuberculosis clinically. We have all seen cases determined clinically as unilateral renal tuberculosis which died in a year or so with frank open tuberculosis of the remaining kidney. Unquestionably to me such cases are bilateral renal tuberculosis to start with, though one cannot so diagnose them from clinical findings.

The tubercle bacilli used in the experiments I believe were bovine. Although the rabbits had very little renal tuberculosis they had progressive lesions in the lungs, spleen, etc.

Dr. Edwin Beer, closing: When Dr. Medlar published his first reports I naturally was rather upset as they seem to point to conclusions which were just the opposite of those entertained by all of us who were dealing with surgical chronic renal tuberculosis.

A careful study, however, of these two papers would scarcely permit the profession to get

the impression that Dr. Rathbun fears may get abroad, namely, that chronic renal tuberculosis is liable to get well spontaneously and that the disease is usually bilateral.

In the experimental work carried out by Medlar, he admits that he is dealing with a totally different type of tuberculous infection from that with which the surgeon deals. He is dealing with a disseminated miliary tuberculosis, whereas we are dealing with a chronic localized lesion. Even in the patients whose kidneys he examined postmortem, he was dealing with exactly the same type of acute or subacute miliary tuberculosis. Unfortunately, he has limited his investigation to serial section of kidney, or kidneys, and has not searched the liver, spleen or other organs for similar miliary tuberculosis. Many years ago with this type of material, I personally had studied in serial section many livers, and in a fair percentage of the studied livers I found miliary tuberculosis as a terminal stage in patients who, macroscopically, showed no hepatic disturbances. I believe that if Dr. Medlar had studied the other organs in the cases whose kidneys he examined, he would have found a similar miliary tuberculosis in the other organs, as many patients suffering from pulmonary tuberculosis are liable to have a wide dissemination of their disease during the terminal months. In other words, they die of what seems to be a subacute or acute miliary tuberculosis. Thus, both experimenal animals and human kidneys present the picture of miliary tuberculosis, which is a well-known entity and usually synonymous with diminished resistance. As I said in my paper, unfortunately this type occurs in kidneys of children with some frequency as they have a definite lack of resistance to the germ of tuberculosis.

As far as the pathological picture is concerned in tuberculosis of the kidney as seen by the surgeon, the disease is rarely (except secondarily) scattered through the cortex. It is usually limited to the medulla or papillary zone, picking out especially the latter, whereas in miliary tuberculosis, the disease is regularly distributed through the cortex, as are the other embolic suppurating diseases due to Staphylococcus aureus or Streptococcus pyogenes. In chronic renal tuberculosis, the tubercle bacillus seems to wander through the excretory tubules and locates either in the terminal collecting tubule or on the surface of a papilla, frequently near the base of the papilla in a caliceal niche. Here they begin to enter between or through epithelial cells and set up a definite lesion of tuberculosis just as they do on the surface of the pelvis, the surface of the ureter or the surface of the bladder. The distinction between these two types is absolutely fundamental and no confusion should be permitted.

Concerning the second point made by Medlar, that tuberculous lesions heal: In his guinea pig 72, he claims that he found at least two lesions which were completely healed or had gone on to a more or less complete fibrosis; but, contradicting this, he says that in one of these lesions, after a long search, he found a single tubercle bacillus. This surely is a contradiction for if one bacillus was still present in one of these two lesions, it surely meant that the disease was not healed in the sense that the tubercle bacillus had been anihilated.

The third point, that all so-called excretory bacilluria were due to ulcerative tuberculous lesions within the kidney and that true excretory bacilluria through a healthy kidney does not occur, may be correct though I have seen cases in which this excretory bacilluria without renal involvement, similar to excretory bacteruria occurring in staphylococcus and streptococcus sepsis, seems to have taken place. Unfortunately, most of the work on excretory tubercle bacilluria has not been well controlled, the males and females having been studied indiscriminately, and, as I said in my paper, in the future only females should be used for this important study so that the prostate and seminal vesicles may not interfere with the correct interpretation of the findings.

The only work that I know of that is fairly well controlled is that by Prof. Kielleuthner of Munich, who, in 12 or 14 cases in which he has studied excretory bacilluria, suceeded in obtaining complete autopsy with examination of the kidneys and genital tract. In his findings, no tuberculosis of the genital or urinary tract was discoverable though a careful search was made. I do not believe that his results can be dismissed offhand. In view of these reports and my own experience, I doubt very much whether we can absolutely deny the existence of an excretory tubercle bacilluria.

FALLOPIAN TUBE STERILITY*

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THE various problems concerned in the etiology, diagnosis, and treatment of sterility must be solved by cooperative effort on the part of the gynecologist, internist, urologist, endocrinologist, and neurologist. The gynecologist, however, must play the major rôle, and he should avail himself of all the useful information obtained by his confrères so that his treatment, whether medical or surgical, can be clearly and definitely indicated. It would seem that in the new light on the studies of sterility, all practitioners whose specialties associate themselves with this subject should endeavor to make themselves particularly skillful so that as the result of combined medical effort the various etiologic factors may be detected in every case. And when one considers that there are about forty possible etiologic factors, any one or any combination of which may produce sterility, the enormity of the problem is evident. One may state that in France, in Germany, and in America, the treatment of fallopian tube sterility has been interesting the profession for about thirty years. It is my opinion that the World War, which sacrificed the lives of over ten million men at their presumable height of fertility, has given a strong impetus to the investigation of sterility in general. During the last fifteen years, progress in the study of the glands of internal secretion, the practical method of determining the patency of the fallopian tubes by gas insufflation and by the injection of radio-opaque fluids, and added to that, the occasional satisfactory results that have followed abdominal section and reparative surgery of the tubes, have all greatly augmented the gynecologist's interest in the study of sterility.

The object of this paper is to make a critical review of the present day methods of the diagnosis and treatment of tubal sterility, and to point out errors of interpretation of findings. It is also my desire to consider the surgical treatment of fallopian tube sterility and to make a plea to gynecologists that more attention be given to the delicate technic required in reparative tubal surgery. Furthermore, one would like to point out that with present day methods of diagnosis, properly executed and interpreted, many more sterile women should be submitted to definitive operation for sterility than have been in the past.

The fallopian tube is arbitrarily divided into three portions, the outer or fimbriated end, the ampulla or middle portion, and the inner or isthmic portion. The details of structure and changes that occur in the outer and middle portions are well known, but it is only recently that careful study of the inner portion has shown clearly the course and structure of the canal. Hermstein and Neustadt and later Geist and Goldberger found that the uterine cavity becomes cone-shaped in the region of each tubal orifice, the apex of the cone being continuous with the lumen of the tube. In this region the mucosa shows a transitional zone of mucosa and a thick longitudinal muscle band appears. Some low folds but no villi are present. The canal varies from ½ to 1 mm. in caliber and so could be easily occluded. Most interesting are their findings concerning the course of the intramural portion of the tube. This varies in length from 1½ to 5 cm. In about 40 per cent it passes in a gentle curve with the convexity upward through the wall of the uterus. Occasionally it rises in a steep curve. In the remaining cases it is tortuous showing either a series of gentle

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convolutions or a course marked by decided angulations, one or two in number. Geist and Goldberger found that the tubes may be symmetrical but that frequently one side presented a gradual curve while the opposite tube pursued a convoluted or angular course.

The fallopian tube is not only a canal, but it is a contractile tube presenting peristaltic movements. The existence of these movements has been observed in animals and can be seen in the human abdomen by means of the fluoroscopic screen after the injection of lipiodol. They possess a peristalsis which plays an important rôle in the passage of the ovum into the uterus. This peristaltic action is absent in diseased tubes. Von Ott injected finely powdered charcoal, suspended in oil, into the abdominal cavity through the culdesac and the powder appeared in the cervix in twenty-four hours. Immediately preceding and during menstruation the permeability of the tube is diminished and is often absent due probably to the edema of the mucosa in and about the uterine ostium.

Douay, to whom we are indebted for much of our information, calls this condition which obtains during menstruation a physiologic impermeability and states that the most favorable time to make a patency test by gas insufflation is several days after menstruation, inasmuch as before and during menstruation, the mucous membrane is hypertrophied to the point of closing the uterine ostium. Daniel showed that the tubal mucosa in its interstitial portion partakes of the same change as does that of the uterus. The period of greatest permeability of the tube corresponds to the time of the dehiscence of the ovum. The follicle ruptures about thirteen days after the commencement of menstruation at the time when the spermatozoa can most easily reach the ovum. The absorption of the follicular liquid is said to have a stimulating action on the tube favoring ciliary motion, peristalsis, and facilitating the passage of the ovum toward the uterus.

If, on attempting to insufflate a normal tube there is a resistance to the gas of about 100 mm. of mercury, one can conclude that the tubes are closed by muscular tonicity. Rubin and others have demonstrated intermittent relaxations and contractions of the tube during insufflation, and Rubin has recorded these phenomena on a kymograph. The knowledge of tubal spasm has resulted in the use of antispasmodics by Meaker and others as a routine in testing tubal patency.

The fallopian tube is normally so flexible and elastic that is has the ability to elongate itself so that it can "reach out" to approach the ovary. The fimbriated end of the tube apparently has the ability to spread itself out over the ovary at the point of rupture of the follicle and this physiologic phenomenon has suggested the operation known as *salpingographie*. The fallopian tube apparently has the ability to search for the ovum in the culdesac and in that way plays an active rôle in fecundation. It would seem, therefore, that when the fallopian tube is functioning normally it has the power to locate the ovum, which is believed not to have any motion in itself, and to draw it into its lumen through the fimbriated extremity by peristaltic and ciliary motion, and probably by other agencies with which we are not acquainted, it is passed onward into the uterus.

IMPERMEABILITY OF THE TUBES

Impermeability of the tubes may result from very minute departures from the normal. Slight adhesions, angulations, twists or kinks in the interstitial portion may produce sterility and the very simple procedure of insufflation or lipiodol injection may reestablish tubal patency. It is generally considered that wherever reparative procedure is used in the tubes, it is most desirable to maintain the fimbriated extremity so that it will retain its normal mobility. If the fimbriated extremity must be sacrificed, the new opening made by salpingostomy should be placed as near the ovary as possible where

it acts as a sort of funnel for the reception of the ovum.

While very minute changes in the tube may result in sterility extreme pathologic changes may not affect the permeability of the tube.

Stenosis of the tube may be congenital, but this is rare. In the infantile type of uterus the tubes are usually permeable, but congenital stenosis does exist and often with atrophy of the entire tube. The tube may very rarely be absent.

Pathologic impermeability may be extrinsic and due to multiple causes. Tumors by pressure may elongate, flatten, or kink the tube; peritoneal adhesions may form as the result of infection producing adhesive bands, twisting, and kinking. Most of these cases are favorable to surgical intervention.

On the other hand intrinsic causes are observed as the result of infection. Oftentimes the stenosis is not dependent upon the severity of the infection as very severe cases may recover with patent tubes, while extremely mild cases may produce bilateral and permanent obliteration. The portions of the tube most usually obliterated are the extremities; first the fimbriated extremity, and next the uterine cornua with the neighboring portions of the isthmus. The intermediary portion is rarely obliterated. Kennedy found 30.8 per cent of closed tubes occluded at the isthmus and 69.8 per cent closed at the fimbria.

The fimbriated end becomes obliterated by simple agglutination of the fimbriae. These cases may be cured by insufflation or by lipiodol injection or by laparotomy in which the adhesions are very gently liberated. In other cases the fimbriated portions have atrophied or entirely disappeared and there is present a cicatricial stenosis, often with a hydrosalpinx. In such cases, salpingostomy is indicated with amputation of the fimbriated extremity. One may find in the milder cases a telescoping of the fimbriated extremity which may be corrected very simply.

In cases of stenosis of the uterine end of the tube, there may be visible a tumor or nodule which deforms the uterine cornua and may extend to a portion of the isthmus. These tumors may be of inflammatory, tuberculous, adenomyomatous or congenital nature and are frequently a cause of sterility because they are habitually bilateral and obliterating. Even slight adhesions, small fibroids, or thickening of the mucosa near the ostium may be sufficient to occlude the tube in this region.

Impermeability of the intermediary portion of the tube is rare and is usually visible and palpable in the course of the operation.

STATISTICS

Statistics seem to show that tubal sterility occurs in about 50 per cent of cases, although the following statistics indicate even a higher percentage.

Serdukoff: 65.5 per cent
Zimmermann: 65.0 per cent in 200 cases
Mandelstamm: 66.0 per cent primary sterility
74.0 per cent secondary sterility
Graff: 50.0 per cent in 400 cases
Douay: 58.0 per cent in 100 cases

In this country, Smiley estimated that in 40 to 45 per cent of the cases, sterility is due to tubal obstruction. Cron found that 55 per cent of 75 cases were nonpatent on CO_2 insufflation. Brandt estimated that 40 per cent of the primary cases of sterility have closed tubes. Rongy found that out of 257 cases of primary sterility, 255 were patent. In 400 cases of insufflation, 142 were found closed.

Douay believes that the percentage of indubitable cases of impermeability does not exceed 25 per cent.

THE DIAGNOSIS OF IMPERMEABILITY

The necessity for a most complete history and of a thorough examination by other members of the medical group in addition to a careful gynecologic examination is paramount if all of the various etiologic factors are to be reckoned with.

It would be desirable to have in every medical center with a population of over one hundred thousand people an organized

sterility clinic such as has been described in a recent article by Meaker.

The gynecologic examination of these cases is usually negative and we believe that in practically every instance it should be made under a general anesthetic. A history of infection should be sought in every case, bearing in mind the grave possibilities of the extremely mild cases many of which are undoubtedly overlooked. As has been remarked by Funck-Brentano and Plauchu: "Gonorrhea is the great plague which keeps on insidiously the extermination of the race."

Puerperal and postabortal infection is probably the second in importance in producing salpingitis with tubal stenosis. Everyone has observed the cases of one child sterility which are due to postnatal infection.

Tuberculosis of the adnexa is an important cause of sterility and it is probably very much more common than we have been led to believe, for it is very difficult to diagnose in many cases. Suppurative appendicitis with its resulting adhesions may also cause occlusion of the fimbria.

It must be remembered that gross lesions may be present with patulous tubes. Cron, in a study of 75 cases, found 14 cases with gross lesions felt on bimanual examination had patulous tubes. I have often observed this phenomenon and recently removed an early pregnant uterus with multiple myomas, weighing 8 pounds. One must remember also that the tubes may be painless and apparently normal and yet impermeable.

During operation, it is oftentimes very difficult to determine whether the tube is patent. Daniel has shown that it is almost impossible to pass a fine probe through a portion of the interstitial part of the tube without making a false passage and augmenting the stenotic lesions. Geist and Goldberger state the reasons and they are readily understood when we consider the caliber and course of the canal in this region. Nurnberger injected methylene blue and indigo carmine to determine tubal patency. Gubareff put sterile graphite into the fimbriated extremity and found the particles in the cervical secretion the next day. Bethel Solomon injected air into the tube through a glass syringe and Curtis has injected salt solution with a syringe. I have endeavored to inject mercurochrome into the tube through the fimbriated extremity, but experienced the same difficulty that others have reported in establishing the presence or absence of patency.

It is not necessary to describe the ingenious insufflation method of Rubin, who in 1919, devised his apparatus which with some modification has come into common use by all workers in the field of sterility. It is hardly possible to estimate the value of Rubin's invention, as an agent in determining the patency of the tubes. The method, however, is not without danger and a number of cases of rupture of the tube as the result of insufflation have been reported. Laurentie reported a case in which rupture of the tube occurred at a pressure of 177 mm. of mercury. Upon opening the abdomen, he found that the gas had produced an emphysema of the broad ligament. The maximum pressure which seems to be considered safe by most observers is from 200 to 225. In our own work, we have never exceeded a pressure of 200 and in an experience covering five years with insufflation we have had no serious after effects.

One must also remember that there is a possible danger of infection in tubal insufflation and Douay advises a bacteriologic examination of the endocervical mucus. One need but refer to the danger of insufflation in the presence of active infection.

Undoubtedly many cases of infection had resulted in the hands of beginners in the work of insufflation. On the other hand, Rubin reports two thousand cases with only one case of double pyosalpingitis.

Douay calls attention to the danger of gaseous embolism owing to the possibility of gas being driven into the uterine vessels. Wilbaux reported three cases, one in which gas embolism produced syncope

which necessitated artificial respiration. Insufflation under general anesthesia also carries with it a danger of gas embolism. One should avoid the use of large quantities of gas at a single time, 150 c.c. is sufficient, and avoid trauma to the mucous membrane with the cannula on account of the danger of embolism.

When gas is introduced into the peritoneal cavity, it rises to the diaphragm producing there an irritation of the phrenic nerve. Pain is not produced during the insufflation, but immediately afterward. Rongy performs the test with the patient in the semirecumbent position to facilitate the rise of gas to the diaphragm. Pain may become severe after the injection of 200 to 500 c.c. In this case, lower the head or place the patient in the genupectoral position when the gas will leave the diaphragm and return to the pelvic region.

SIGNS OF PERMEABILITY OF THE TUBES

If the tubes are patent, there will be a sudden lowering of the pressure to 100 or even 60. One must have perfect sealing of the instrument in the cervical canal to avoid error in this respect. Some have filled the vaginal vault with sterile water or saline for this reason. Others have used lubricant to coat the rubber cuff of the cannula so that bubbles may be readily seen if there is a leak.

Certain uteri will distend and hold 10 to 45 c.c. of gas, likewise certain tubes will hold 10 to 30 c.c. Furthermore, the gas may pass into the vessels or into the cellular tissue and simulate a patent tube. It is also possible to rupture a tube and believe the tube to be patent.

By auscultation with the stethoscope over the abdomen, one can hear the gas bubbling through the tubes, but one may mistake the bruit caused by the gas escaping through an improperly occluded cervix for the proper sound. Ottow introduced a phonendoscope into the rectum, which was satisfactory. Douay draws attention to a tympanitic percussion sign called *disparition de la matite' bépatique* which can be evoked over 60 to 150 c.c. of gas. The roentgen ray verifies the presence of gas in the peritoneal cavity.

Scapular pain is nearly always present. Usually it is on the right side, although it may appear on the left. It may also appear at the base of the neck, in the shoulder and sometimes in the center at the base of the thorax.

IMPERMEABILITY

One must be assured of impermeability, the test must be repeated and at the proper time in the menstrual cycle. The swelling and thickening of the uterine mucosa may obliterate the orifice of the tubes at the uterine ostium. Rubin considers four to seven days after cessation of menstruation the time of choice because:

1. The mucosa is thinnest the week after menstruation and offers the least obstruction.
2. There is almost total absence of secretion in the postmenstrual interval.
3. Elimination of possible displacement of an unimpregnated ovum.
4. Danger of insufflation in early pregnancy.
5. Minimal risk of carrying infection upward.
6. Safety from endometrial dislocation.
7. Overcoming obstruction just before ovulation is expected. One should test the patency five times at each sitting allowing the pressure to rise a little higher each time, until a maximum of at least 200 mm. of mercury is attained.

Spasm plays an important part and is probably produced at the internal os where it acts as an obstacle to the passage of the cannula and at the uterine ostium of the tube where the muscular coat of the tube is thick and resists distention. The latter occurs when the uterus fills with gas; as the uterus contracts, if the joint between cannula and cervix is properly sealed, small amounts of gas penetrate intermittently into the tubes. Rubin has shown this rhythmic action by kymographic record. One must remember the incidence of uterotubal spasm and one should not conclude that the tubes are impermeable

without making a number of patency tests. Meaker employes the administration of benzyl benzoate and advises its use after intercourse in such cases. Douay had five successful cases, while Graff tried the antispasmodic treatment in eleven cases without obtaining any better results with insufflation.

If operating for other conditions on cases of sterility, the patency of the tubes can be definitely established by insufflating while the abdomen is open, when one can see the gas bubble through the fimbriated ends of the tubes. Insufflation is also used to establish the patency of tubes after plastic operations upon them to restore the lumen. This should not be done too soon after operation on account of the danger of gas embolism.

THERAPEUTIC RESULTS OF TUBAL INSUFFLATION

The method evidently has some definite therapeutic action. Cron concluded that tubes with constricted or obstructed lumina at either the proximal or distal end may be dilated sufficiently by the gas to permit the passage of an ovum. Rubin and others think that insufflation separates light adhesions and dislodges mucous plugs in the narrow portions of the tubes. Douay found in 100 insufflations that pregnancy followed in 8 cases.

Graff obtained a result in 10.1 per cent in 376 cases. Rubin states that 14.5 per cent have become pregnant following insufflation in a series of 2000 cases.

Some have recommended insufflation following coitus in the hope of driving the spermatozoa into the tubes. The author has tried this a few times without success, but feels that the danger of infection is too great in this procedure to warrant its frequent use. He has records of three indisputable cases of full-term pregnancy following insufflation and one case in which ectopic pregnancy developed four months later.

Sellheim has devised an insufflation apparatus in which the spermatic fluid can be injected with the stream of gas.

RADIOGRAPHY OF TUBES

While the Rubin test yields information by determining the patency or occlusion of the fallopian tubes, it still leaves us without important data necessary to establish a plan for procedure in that it is impossible to locate the point of obstruction. To this end numerous methods were tried before a satisfactory one was found. Le Lorier about 1912, injected an isotonic nonirritating liquid into the uterus with a view of ascertaining the patency of the tubes. In 1913 Dimier used a 10 per cent solution of Collargol for this purpose. One patient died of peritonitis following the injection and acting on the advice of Possi, the method was abandoned. In 1914, W. H. Cary first used Collargol in this country, but its use was abandoned. In 1915, Rubin also employed Collargol, but found it too irritating; he then used Thorium Citrate. In 1923, W. T. Kennedy reported on the radiography of closed tubes using sodium bromide for injection into specimens removed at operation. By this means he was able to determine the point of occlusion of the tubes. Tussau and Macquot reported on the use of a suspension of bismuth as a means of demonstrating the shape of the uterine cavity in fibroids. The use of iodized oil for diagnosis began in 1922 when Sicard and Forestier reported on its use intraspinally as a method of localizing spinal cord tumors. They employed a 40 per cent iodine in poppy seed oil. In the same year Forestier and LeRoux described the technic for injection of lungs and the bronchi. This was followed by the work of Pritchard, White and Gordon on the diagnosis of bronchial conditions.

In 1925, Carlos Heuser, of Beunos Aires, reported the intrauterine use of lipiodol in the diagnosis of early pregnancy. Carreras in 1926 employed the oil to visualize the uterus and tubes. Stein and Arens were able to outline an ovarian cyst after the transuterine injection. Newell reported the results in 38 cases in which there were no unfavorable reactions. He found it of diagnostic value in cases of

sterility. Similar series were reported in the same year by Henkel, Gregoire, Beclere and Darbois, Rubin and Benedick, Jarcho, and others. Rubin and Bendick described a study on the peristalsis in fallopian tubes visualized by means of the iodized oil. McCready and Ryan were able to establish the point of occlusion in the tubes.

Occlusion of tubes having been ascertained by means of the Rubin insufflation method, the point of obstruction can be located by roentgenography following the injection of iodized oil. The patient is placed in the dorsal position on a cystoscopic table, 10 c.c. of the oil is drawn into a record syringe, this is attached to a Utzman-Keyes cannula which is inserted into the cervix and about 5 c.c. is injected. One then waits about thirty seconds to one minute until the spasm caused by the distention has relaxed and the remainder is injected. Roentgenograms are then taken and repeated in twenty-four hours. These should be taken stereoscopically.

If the uterine cavity fills and nothing passes into the tubes, the obstruction is at the uterine ostium. If the lipiodol engages itself in the interstitial portion, but does not penetrate the isthmus, one is reasonably certain of an obliterating nodular salpingitis. If the lipiodol stops at the junction of the isthmus and ampulla, it indicates a lesion at that point or an extensive lesion such as a closed hydrosalpinx. If it fills the tube but does not pass into the peritoneal cavity, it means an open hydrosalpinx with dilated tubes, in which case it forms rounded masses in the tubes. If the tube is obliterated at the fimbriated end without hydrosalpinx, the roentgenogram shows a small thin ribbon-like shadow which ends in a protuberance at the level of the fimbriated extremity.

When the oil enters the peritoneal cavity it breaks up into small masses, indented and patchy in appearance. It is sometimes advisable to repeat the roentgenography the following day by which time the uterus and tubes are empty but the lipiodol rests in small irregular masses in the peritoneal cavity. Douay recommended light massage in the tubal region; if the tube is open the droplets of oil can be seen spreading about between the coils of small intestine.

The dangers in the use of lipiodol are similar to those of insufflation, chiefly infection, tubal rupture and embolism. As with insufflation, they are not frequent results. Beclere showed that embolism could be produced since the oil enters the blood vessels when a pressure of 400 mm. of mercury is reached. Likewise tubal rupture might occur if the pressure rises much above 200 mm. of mercury. Iodine poisoning from absorption from the peritoneal cavity may occur and it is therefore rarely used when the tubes are patent. It may remain in diseased tubes for some time.

It has been brought out that the time of election for lipiodol injection is just before menstruation, as it is then less likely to get into the peritoneal cavity.

By careful interpretation of the roentgenograms obtained, one is able to check the patency of the tubes and to locate the point of obstruction in cases of occlusion. In addition, lipiodol is thought to have some definite therapeutic value by the slow liberation of iodine as suggested by Jarcho. The author has had one case that became pregnant shortly after the transuterine injection of lipiodol. And lastly Cotte has employed the method to check the patency of tubes after uterotubal implantation.

THE SURGICAL TREATMENT OF IMPERMEABLE TUBES

Plastic operations on the tubes for the relief of sterility have been attended with very little success in the past. Undoubtedly a large part of these failures were due to uncertainties in the diagnosis and inability to accurately localize tubal obstruction, if present. But with the methods at hand, one is now in a position to determine whether the tubes are closed or not and if so at what point obstruction has occurred.

Those in which the obstruction is at or near the fimbria are considered favorable for operative relief, while those in which the tube is occluded in or near its interstitial portion are unfavorable.

Before advising operative procedure, other factors in the production of sterility must be ruled out and the tubes found to be closed on successive attempts with insufflation. The tubal factor then comes into the foreground and should be studied thoroughly in regard to history of previous gonorrheal infections, postpartum or postabortum inflammatory disease, suppurative appendicitis, tuberculosis and neoplasms. It is obvious that no active treatment should be attempted on cases showing evidence of acute or subacute infection. Douay advised diathermy, massage and hydrotherapy in those cases of old infection with partially occluded tubes. Smiley emphasized the importance of eradicating any chronic foci in the lower genital tract and particularly the cervix before attempting plastic repair of the tubes. Richard von Steinbuchel does not favor insufflation but prefers the operative investigation of the pelvis when the history or gross findings suggest tubal obstruction.

The first recorded operation for the relief of occlusion of the fallopian tubes was performed by A. Martin, in 1885, who incised the closed fimbriated end of the tubes and sutured the tubal mucosa to the peritoneum. Skutsch, in 1889, employed a circular mucoserous suture producing eversion of the mucosa. This was followed by the Dudley operation in 1898, which consisted of transverse section, oblation of the external segment and suture of the cut end as in circumcision.

It appears that little enthusiasm was aroused since Gellhorn, reporting a successful case in 1911, was able to collect only thirteen cases from the literature. With the advent of the Rubin test, by which the patency or nonpatency of the fallopian tubes could be definitely established, new interest was stimulated and the German, French and English literature now contain numerous references to the operative correction of tubal sterility. That definite progress has been made is shown by the report of Bethel Solomon in 1927, in which 32 pregnancies occurred after removing adhesions at the fimbriated end of the tubes in a series of 75 cases. His cases of repair following disease of the isthmus and intramural portion show that there is still much to be gained in perfecting the technic of these operations. Kerwin and Gellhorn have performed salpingostomy on 50 cases with resulting pregnancies in 25 per cent. They draw particular attention to careful technic to avoid injury or bleeding and do not favor the injection of iodized oil before operation.

Solomon, who has had an extensive experience with the operation of salpingostomy, has divided the operative procedures into four classes according to the location and extent of the lesion:

1. Release of adhesions at the fimbriated end of the fallopian tube.
2. Resection at the fimbriated end of the tube.
3. Operation for disease at the isthmus of the tube.
4. Operation for disease at the uterine end of the tube.

It is his opinion that when tuberculosis of the tubes is present, the sterility cannot be cured and that the tubes should be removed in their entirety. This opinion is shared by others.

When there are simple adhesions at the fibriated extremity, these are gently freed and a strand of No. 2 catgut is placed in the tube to prevent it closing again. If more extensive disease is present, the fimbriated end may be resected. When the disease is in the isthmus, Solomon does an end to end anastomosis, but is not so hopeful of good results. When the disease is at the uterine end of the tube, the diseased portion is removed, the uterine ostium exposed, the uterus bisected and the tube sutured into place.

Insufflation may be of value during the operation and the patency of the tubes

should be tested again after operation by the Rubin method. Outstanding among other methods that have been used are the *salpingorrhaphie* of Pozzi, in which the fimbriated end of the tube is attached about the ovary after releasing the adhesions; the incorporation of a portion of the ovary with mesovarium into the tube as devised by Gersuny in 1896 and practiced by Clado later; tubo-uterine implantation as used by Riess and Watkins, Shaw and Cullen, Cotte and others; and grafting or implantation of the ovary into the uterus, a method first used by Morris in 1895. Bainbridge, in 1905, grafted a portion of the ovary into the uterine cornu and a normal pregnancy resulted one and one-half years after operation. In another case following the same operation, the patient became pregnant twelve years later.

CONCLUSIONS

1. It appears that 40 to 50 per cent of all sterility is due to obstruction of the fallopian tubes.

2. With modern methods of diagnosis, it is possible to determine definitely the patency of the fallopian tubes.

3. In cases of tubal obstruction, the point of occlusion can be accurately located by radiography.

4. Since tubal obstruction forms an absolute barrier to conception, operative procedure with the primary object of restoring tubal patency should be considered in every case.

5. With recent advances in technic, the results from reparative surgery are encouraging.

6. We wish to make a plea for thorough investigation of all cases of sterility remembering that those of tubal origin are no longer entirely hopeless.

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TUBERCULOSIS OF THE THYROID GLAND*

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TUBERCULOUS infection of the thyroid gland is a rare condition. Although of late several excellent reports have appeared in the literature, the incidence of thyroid tuberculosis is still very low. Quite naturally the earliest reported cases were those discovered at postmortem examination, the majority of these being cases of miliary tuberculosis in which the infection was so acute and overwhelming that all organs were involved. Even so, it was noted by pathologists that only a very small percentage of such cases showed thyroid involvement and this observation led to such statements as that of Virchow that "the presence of a goiter was proof that the subject was not tuberculous." Some pathologists even went so far as to say that the thyroid gland was never invaded by tuberculosis.

With the development of surgery of the thyroid gland and the coincident thorough gross and microscopic examination of tissue removed at operation, the pathologic processes to which the thyroid is subject have become better known and more carefully studied. It would seem that with an increase in the number of glands studied the number of cases of tuberculous involvement would increase also but this has not been the case. Thus in 1917 Mosiman[1] reported 9 cases of tuberculosis of the thyroid from Crile's clinic, representing an incidence of less than 1 per cent. In 1920, Plummer and Broders[2] reported only 7 cases from the Mayo Clinic. An excellent review of the subject was presented by Coller and Huggins[3] in 1926 in which they summarized all reported cases, adding 5 of their own, which represented the total number of cases of thyroid tuberculosis encountered in 1200 thyroid cases treated by operation. In looking over the literature on the subject 2 additional cases[4,5] not included in their report were discovered. Since 1926 there have appeared several reports: Higgins[6] reported 5 additional cases from Crile's clinic between the years of 1921–1926; an incidence of 0.15 per cent in the total series (including 1917 report by Mosiman); Smith and Leech[7] reported 3 cases encountered in some 1500 thyroid operations and 100 autopsies in the Lahey clinic, an incidence of 0.25 per cent; Askanazy[8] and E. Marcuse[9] each reported 2 cases. The 2 cases reported in the present communication are the only cases encountered in 67 thyroid operations since the opening of the clinic two years ago, an incidence of 3 per cent.

Case 1 (6676). W. G., male, aged sixty-four, was admitted to Strong Memorial Hospital April 18, 1927 complaining of a lump in the neck. A small tumor the size of a walnut was first noticed three months before admission. This increased rapidly in size and there was some dysphagia for six months with hoarseness for three or four weeks. There were no symptoms of hyperthyroidism. The main physical findings aside from the local condition were undernourishment, arteriosclerosis with hypertension (B.P. 200/100), emphysema, cardiac hypertrophy, prostatic hypertrophy, left inguinal hernia and bilateral varicose veins. The thyroid showed little if any generalized enlargement but there was a prominent tumor over the isthmus 5 to 7 cm. in diameter. This tumor moved on deglutition, was tense, encapsulated, non-fluctuant, not painful and the skin was not adherent. The whole tumor was freely moveable up and down but not laterally. A preoperative diagnosis of adenoma of the thyroid with hemorrhage and cystic degeneration was made.

Operation was performed (T. B. J., April 20, 1920) under 1 per cent procaine anesthesia. The usual necklace incision was made. The ribbon muscles were densely adherent to the tumor and the field of operation presented

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evidence of a diffuse chronic inflammatory process. At this stage of the operation the remark was made by the operator that the difficulty of dissection suggested that encountered in tuberculous adenitis. No line of cleavage could be found between the ribbon muscles and tumor. After freeing the muscles attempts were made to enucleate the tumor which was identified as arising from the isthmus of the thyroid. During dissection the capsule of the tumor was broken and immediately there escaped a thick creamy yellow pus containing small caseous particles. No further attempts were made to enucleate the mass. The anterior part of the thick fibrous capsule was removed and the posterior aspect was seen to be composed of thyroid tissue, much altered by inflammatory reaction. All caseous and necrotic tissue was removed and the ribbon muscles sutured loosely in the midline, and skin flaps closed with a small subcutaneous drain.

The patient had an uneventful postoperative convalescence; the drain was removed in twenty-four hours and there continued to be slight serous drainage. Intensive ultraviolet light therapy was used with considerable improvement. The patient, however, disappeared before the wound was entirely healed and attempts to locate him have been unsuccessful. Pathologic report on a very small piece of tissue showed no thyroid tissue but a diffuse chronic inflammation with areas of necrosis and giant cells. No tubercles could be identified. However, a guinea pig innoculated with pus obtained at operation was autopsied May 27 and found to have extensive generalized tuberculosis.

Case II (11,423). J. C., female, aged fifty-nine, was admitted to the Strong Memorial Hospital, November 28, 1927, complaining of "pounding and fluttering over the heart," insomnia, weakness and fatigue. The present illness began five months before admission with the symptoms noted. The palpitation became accentuated eight weeks before admission and the patient was sent in the hospital for observation by her physician. The past history was rather interesting in that twenty-eight years before admission the patient had her left breast amputated for "chronic ulceration not carcinoma." The patient's mother had "nervous goiter" and died following operation at the age of seventy. Her father died at sixty-eight of tuberculosis. One brother died at the age of thirty of tuberculosis. The patient's best weight was 168 pounds, twelve years before admission, her average weight was 144 pounds.

The positive findings on physical examination at the time of admission were: emaciation, hyperactivity and nervousness, slight tremor of eyelids and hands; the thyroid was palpable but not markedly enlarged, smooth with no nodules; a bruit was audible over right pole of thyroid; examination of the chest showed slight impairment of the percussion note in the right interscapular region and at the right apex anteriorly but the breath sounds were normal. The heart was negative except for a systolic murmur at the base, B.P. 145/75, rate 80. There was slight sclerosis of the radial vessels. Abdominal, pelvic and rectal examinations were negative. The extremities were negative except for moist skin. The reflexes were slightly hyperactive. Laboratory findings: R.B.C. 5,380,000; W.B.C. 9180; Hb. 90 per cent; N.P.N. 38.7 Roentgen-ray examination of the chest showed an obsolete tuberculosis with calcification of glands at the hilus. The basal metabolic rate was plus 21; the Wassermann reaction was negative; the electrocardiogram was normal. On several occasions the patient developed paroxysmal auricular fibrillation. Under treatment with Lugols solution her symptoms improved, the B.M.R. dropping to plus 9 per cent. The case was diagnosed as one of hyperthyroidism.

Operation was performed (December 20, 1927, T.B.J.). The gland appeared slightly enlarged, rather friable and quite similar to the usual hyperplastic gland. A subtotal thyroidectomy was done and the wound closed without drainage. The wound healed per primam. The second day after operation the patient had an attack of auricular fibrillation lasting an hour or two. Eleven days after operation, the basal metabolism rate was minus 15 per cent arising to minus 4 per cent on the eighteenth day. There were transient attacks of auricular fibrillation during the first week after operation but none thereafter. Patient improved daily, with considerable diminution of nervousness and was discharged January 7, 1928.

Pathologic report: The specimen consists of part of two lobes of thyroid tissue 2.4 by 3 by 1.5 weighing 12 gm. each, meaty, friable of uniform consistency. Microscopic examination:

The sections show thyroid tissue with rather small acini, in places almost obliterated. There is considerable round cell infiltration. No marked hyperplasia. There are numerous tubercles with giant cells.

DISCUSSION

In general these cases pathologically are quite similar to other reported cases. The first case presented the more unusual pathologic picture, that of a tuberculous abscess. From the appearance of the operative field it would seem that at one time the thyroid gland had been the seat of a rather extensive and active inflammation. The second case showed the picture of diffuse involvement with some fibrosis and numerous tubercles but very little hyperplasia of the gland structures. Considerable has been written on the subject as regards the types of pathologic picture most often encountered and the types of glands involved, whether normal, hyperplastic or adenomatous. Thus Higgins[1] feels that tuberculosis of the thyroid gland is most commonly associated with hyperthyroidism, pointing out that 10 of the 14 cases from Crile's series showed increased activity.

This naturally brings up the question as to whether the tuberculous infection causes a hyperplasia of the remaining glandular tissue or the hyperplastic gland is more susceptible to tuberculous infection than a normal gland. Torri,[10] and Roger and Garnier[11] as early as 1900 produced tuberculosis of the thyroid gland by injecting emulsions of the tubercle bacilli into the thyroid and carotid arteries of guinea pigs and rabbits. The former noted that the infection was limited to the injected side, and the outstanding features were the new formation of follicles, proliferation of the epithelium, and an increase in colloid. He also noted microscopically that sections of glands taken one to three days after injection showed the bacilli in the colloid to be granular and less easily stained than those lying in the stroma and that sections of glands taken ten days after injection showed no organisms in the colloid. He interpreted this as evidence that the colloid had a definite antagonistic and destructive influence toward the tubercle bacilli. He also noted that the addition of thyroid extract to his cultures of tubercle bacilli prevented further growth. Since the lack of colloid in hyperplastic glands is one of the outstanding features it might seem plausible to attribute Higgins' findings to this feature. On the other hand Coller and Huggins[3] conclude from their review of reported cases that the hyperplastic gland is not more susceptible to tuberculous infection. Their survey showed that the majority of reported cases occurred in adenomatous glands. They also feel that evidence tends to show that tuberculosis of the thyroid gland produces no dysfunction other than a tendency to myxedema by a destruction of gland tissue and subsequent fibrosis. No definite statements can be made on these points until further clinical and experimental evidence accumulates.

In considering the different types of pathologic pictures encountered such as diffuse miliary tubercles, "cold abscess," fibrosis, etc., it seems that little can be gained by considering the relative frequency with which each type is encountered. All represent tuberculous infection and undoubtedly the pathologic picture in each case depends on the classical factors influencing infection anywhere in the body, namely, the resistence of the patient and tissue involved, the virulence of the organism, etc.

Clinically these 2 cases present nothing unusual unless it be the suggestive history in the second case. The patient gave a history of tuberculosis in the family (father and brother died of tuberculosis), she herself had had a chronic ulcerative lesion of one breast (not carcinoma) some years before and the roentgenogram of her chest showed an old tuberculosis of the lung. Considering this in retrospect it presents an excellent setting for tuber-

culosis of the thyroid. Here again the cases were quite in accordance with other reported cases in that the diagnosis was not only missed but not even considered. In only one instance of all the reported cases was the diagnosis of tuberculosis even considered. This naturally brings up the question of differential diagnosis of tuberculosis of the thyroid gland and after studying the subject carefully we are forced to admit that there are no diagnostic points peculiar to this condition alone. The observation made most frequently has been that the glands are very firm, hard and fixed, in some instances with skin adherent, so as to suggest carcinoma but even these features are not sufficiently constant to be of much value. Until we have more experience with such cases and develop more exact diagnostic methods it seems highly probable that the condition will continue to pass unrecognized unless discovered by microscopic examination of the gland tissue.

Although admitting failure in the matter of diagnosis we are better equipped therapeutically, for subtotal thyroidectomy in these cases gives excellent results. Even in the cases with the most extensive tuberculous invasion the majority of wounds heal per primam and symptoms are relieved. It seems, therefore, that nature here, as in so many instances, compensates for our mistakes.

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FRACTURES OF TRUE PELVIC RING*

REVIEW OF 100 CASES TREATED AT FORDHAM HOSPITAL 1918-1928

(STATISTICS AND DISCUSSION OF TREATMENT)

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WITH the increase of automobile and industrial accidents comes an increase in the number of fractures. The regular resort to roentgen ray has shown us that many fractures which were considered rare, in reality are quite common. It is of great importance to review these rare fractures from time to time. Perhaps more light will be thrown on the etiology, symptoms and methods of treatment and the old dogmas will be changed.

TABLE I

NUMBER OF PATIENTS[1]

1918	2
1919	2
1920	4
1921	6
1922	8
1923	10
1924	14
1925	21
1926	10
1927	19
1928	4
Total	100

[1] There were more than 100 cases but we reported only cases that had definite lesion of the pelvis and their main symptoms were due to the pelvis. There were many more who had such severe fractures of other bones that the pelvis fracture was very insignificant. To make a rough estimate, there were about 50 more in the years 1918 to 1927. The 4 cases in 1928 were the first ones, occurring in this year; these are added to complete the 100 cases.

TABLE II

SEX

Male	72
Female	28

TABLE III

AGES

One to ten	8
Ten to twenty	21
Twenty to thirty	27
Thirty to forty	10
Forty to fifty	14
Fifty to sixty	11
Above	7
Unknown	2

TABLE IV

OCCUPATION

Laborer	27
Professional	2
Driver	10
Office Work	10
Painter	1
Students	9
Housework	10
Tailor	4
Plumber	2
Carpenter	2
Policeman and Fireman	2
Undetermined	21
Total	100

TABLE V

CAUSE[1]

Auto and car accident	68
Industrial accident	28
Jumping	2
Undetermined	2

[1] The fact that so large a percentage (68 per cent) of our cases was due to auto accident is apparently due to the situation of Fordham Hospital in the heart of a heavy automobile zone and the large ambulance area.

One of these types is the fracture of the true pelvis. When I looked up the cases that were treated at Fordham Hospital during the years 1918–1928, I was surprised to find the number so large. Westerhorn[4] published an extensive paper based on 513 cases of fractures and dislocations of the pelvis from the records of four large hospitals in Sweden and several insurance companies.

Sever[2] recently published a paper on fractures of the pelvis (all parts of the pelvis) and reviewed the literature carefully. He found that the literature is rather pessimistic about results and it is still claimed that such fractures are rare. His studies lead him to believe that pelvic fractures are not rare and the results on the whole are extraordinarily good, if not anatomically, at least functionally. I hope that this presentation may bring

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about enough discussion to clear up some of the erroneous beliefs that are prevalent concerning this fracture and suggest reliable methods of treatment.

Before discussing the cases, I believe that it would be of interest to give a short review of the important facts of these fractures and compare them with our statistics.

ANATOMICAL CONSIDERATION

The pelvic ring is formed by the pubic arch anteriorly with the symphysis in the middle, the rami of the pubis and ischia on the side and the great sarosciatic ligaments and coccyx posteriorly.

Though the pelvic bones are generally considered inaccessible, still all the parts of the pelvic bones may be palpated by a careful anatomic examination assisted by rectal and vaginal examinations. Roentgenological examination will accurately locate a fracture.

ETIOLOGY

Factors in the Etiology are (1) great violence; (2) falls from heights (in such cases it is due to sudden pressure upon the pelvis through the thighs and hips or through the spinal column upon the sacrum and sacroiliac synchondrosis); (3) crush between two moving objects (car collision); (4) fall of a heavy beam; (5) fall of a mass such as coal or rock. The causes in our group are shown in Table v.

CLASSIFICATION

Injuries of the pelvic ring, i.e. those in which the continuity of the girdle is broken, comprise: (1) Fracture of the rami of the pubis; (2) multiple fractures of the pelvic ring; (3) separation of the symphysis pubis; (4) dislocation of the sacroiliac joint.

Westerhorn[4] divides them into (1) anterior ring fractures with separation of the symphysis; (2) posterior ring fractures; (3) double vertical fracture with separation of the sacroiliac articulations; and (4) fractures of the floor of the acetabulum. These fractures are usually multiple.

As it is so hard to diagnose real dislocation of the sacroiliac joint and as many careful observers still doubt the existence of such a condition, I have not included in this series any cases where the diagnosis of sacroiliac dislocation was made or suspected. The series includes cases of real fractures only. These statistics do not include fractures of the tip or crest of the ilium only or central fractures of the acetabulum alone. There were many cases in which a diagnosis of injury to the pelvis was made but not verified as the patient either died or left before the roentgenogram was taken. These were also not included. If I should include all these cases the number over the same period would easily reach 200. The different fractures are shown in Table VI.

TABLE VI

REGION INVOLVED[1]

One ramus on one side	36
Two rami on same side	26
Two rami, one on each side	2
Four rami	1
Ischium and acetabulum	11
Ilium	3
Os pubis	8
Undetermined	13

Roentgenograms were taken in 87 cases.

[1] The region involved was determined by roentgenogram. The 13 "undetermined" were cases where we had no chance to take roentgenogram as either the patient died or left early against advice. We always paid more attention to the shock and treating the general symptoms than to hasten to determine exactly the region involved. Under the classification, ilium, we included 3 cases in which a large portion of the wing of the ilium down to the ischium or acetabulum was involved.

It will be seen that in our series, the percentage of fracture of the rami is higher than that for the other regions of the pelvis. This coincides with the statistics of other observers. Westerhorn states:[4]

Partial fracture of the anterior portion of the pelvic girdle is rare. A diagnosis of fracture of a single pubic ramus is often made when in reality the other ramus or the inferior ramus of the pubis is also broken through, the fracture being therefore of the girdle-disrupting type . . . Fractures of the pelvic ring (disruption

of continuity of the pelvic girdle) are more frequent, more serious, more often complicated, and more difficult to treat than simple fractures of the pelvic brim . . . Anterior ring fractures are unilateral about five times as frequently as they are bilateral, but when they are associated with posterior ring fractures they are unilateral and bilateral with about equal frequency . . . Posterior ring fractures are rarely isolated.

SYMPTOMS

Besides the ordinary symptoms common to fracture or severe injury (frequently shock), one finds: (1) pain, localized at the points of fracture, but elicited when compression is applied to the pelvic girdle or when the pelvis is rocked slightly up and down; (2) crepitus, when tested or when patient is turned over; (3) ecchymosis. (4) walking may be possible but is accompanied with a great deal of pain. (5) There may be apparent leg shortening or palpable change in the pubic contour if the displacement is marked. (6) If complications are present, there will of course be additional symptoms (Table VII).

Table VII
SYMPTOMS

Pain	59
Disability	8
Brought in unconscious	7
Brought in in shock	8

[1] We have noted that 7 patients were brought in unconscious. There were many more who gave a distinct history of having been unconscious or dizzy for some moments and then recovered consciousness. The symptoms noted were those that were prominent. There were some patients who complained very little and the diagnosis was made mainly on palpation.

COMPLICATIONS

There may be rupture of bladder, urethra or bowel. Occasionally there may be a rupture of the kidney. The primary or secondary shock will be very great. Less commonly, the vagina, the rectum and the iliac blood vessels are damaged.

The complications in our series are shown in Table VIII.

Table VIII
COMPLICATIONS

Ruptured bladder	6
Urinary symptoms	1
Marked destruction of tissues	5
Fractures of other bones	7

DIAGNOSIS AND EXAMINATION

Scudder[1] summarizes as follows:

The examination should be systematically made in order to cover thoroughly the irregular bones of the pelvis. The ilium of each side should be palpated to detect a fracture of either crest. Then the two ilia should be crowded gently but firmly together in order to determine crepitus due to the presence of fracture elsewhere. Then the pubis and ischium upon the two sides are to be palpated externally as far as is practicable. Finally a careful rectal and vaginal examination should be made of the pelvic bones. The rectal examination will help to determine actual damage to the rectal wall and it may assist in determining impending damage from projecting sharp spicules of bone. The patient should be catheterized to assist in determining the presence of an injury to the urinary tract.

Concerning the diagnosis of complications Speed[3] says:

Rapidly increasing dullness in the flanks or lower abdomen within the first twelve hours after injury indicates intraperitoneal rupture of the bladder and peritonitis. Hemorrhage is differentiated by signs of greater shock. Perineal and scrotal swelling of urinary extravasation which follow injury of the bulbous portion of the urethra takes twelve to eighteen hours to develop. Extravasation of blood and urine into the groins and pubic regions indicates extraperitoneal rupture of the bladder or urethral injury back of the triangular ligament. The time of onset of this sign depends on the amount of urine in the bladder at the time of accident, but it is usually slower than the perineal swelling.

The roentgen-ray of course indicates the character of the fracture.

PROGNOSIS

In uncomplicated cases, the prognosis is good. Union occurs in from eight to ten weeks. If the acetabulum is not involved, the return to function is complete.

It will be interesting to note what Sever[2] quotes from Llewellyn and Jones' valuable and interesting book on "Pensions and the Principles of Their Evaluation."

They discuss fractures of the pelvis in terms of their title. They believe that fractures, single and multiple, of the pelvic bones may occasion permanent incapacity and should be evaluated at 100 per cent disability, fractures less severe from 25 per cent to 80 per cent. They believe that these fractures, are the outcome of direct and severe violence, and that their gravity consists essentially of the probability of associated lesions in the pelvic viscera. They also state that these soft part lesions are more common following fractures of the brim of the pelvis. An obstructed pelvic outlet in women is not an uncommon result with fractures of the brim and acetabulum. They estimate the mortality of all types at 50 per cent, which seems rather large.

In reference to the influence of fractured pelvis on labor, Williams[5] says:

> In rare instances healed fractures of the pelvis may offer an insuperable obstacle to the birth of the child, owing either to an excessive formation of callus or to the projection of the broken ends of the bones into the pelvic cavity . . . The effect upon labor depends upon the location of the fracture and its manner of healing.

I have discussed this question with many competent obstetricians of this city and they cannot recollect any case that caused special trouble during the delivery. The fact that men who have very large obstetric services do not recall "labor complications" following fracture of pelvis is a fair indication that complications are infrequent or insignificant.

Dr. K. DeLee in a personal note writes:

> I have had several cases of fracture of the pelvis to treat and do not find they present any unusual problems. It is simply a matter as to whether the dislocated ends of the fractured bones or a large callus produces a mechanical obstruction in delivery and I treat the case as I would a pelvis contracted from any other cause.

In the series of cases presented, a definite conclusion as to the length of time the patient is to be confined to bed is extremely difficult. Fordham is a city hospital, free, and therefore patients, keeping constantly in mind the legal aspects of their disability, insist on remaining in bed and in the hospital as long as they are tolerated. In the cases due to industrial accidents, the compensation insurance companies use many devices to leave patients at Fordham for longer periods since they do not pay for medical services. Our general impression, however, is that in the uncomplicated cases the patient can be discharged from the hospital in two to three weeks but should stay in bed for a few weeks longer.

Table x gives the condition of the patients on leaving the hospital. We have tried to get the end-results. Questionnaires were sent out recently to 70 patients whose final conditions were not known to us. Only 13 responded. Questions were as follows:

1. Are you entirely cured from the condition?
2. Are you able to follow your previous occupation?
3. How soon, approximately, after your discharge from the hospital, were you able to return to work?

Responses:

1. Yes.....11 No.....2
2. Yes.....10 No.....3
3. From two to six months.

TREATMENT

We will not take up the treatment of the shock nor the complicating visceral injuries. The latter usually falls in the domain of the general surgeon. At the first possible moment, the matter of visceral damage should be investigated by analysis of the patients' symptoms, palpation of the abdomen and examination of the urine; catheterization being employed in the event of inability to void or the presence of hematuria. If visceral damage is present, it should be attended to immediately as the fracture then constitutes only a minor item.

Treatment of the Fracture Proper. The patient is put on a Bradford frame with

a pillow under the knees to relieve the drag of the extremities upon the pelvis. A broad strip of adhesive plaster may be applied to the pelvis, the ends being brought around the front and a piece of felt applied over the pubic hair protects the patient against the adhesive plaster. Another piece of felt is applied in the back over the sacrum. Wilson and Cochrane[6] advise that "The ends are brought around in front and doubled back on themselves to provide a firm support for the insertion of a lacing of bandage or other material which is used to tie them together tightly in front of the pubis." Scudder[1] advises immobilizing the pelvis by encircling the thighs separately or together to the frame with a towel swathe.

Westerhorn[4] warns:

> It should be borne in mind that too long bed rest leads to prolonged disability and that massage and passive movements should be begun early in these cases of fracture as in others . . . In fractures of the wing of the ilium it is rarely necessary to keep the patient in bed longer than three weeks. In fractures of the sacrum the patient is kept in bed three weeks. In anterior ring fractures patient should remain in bed for three or four weeks. Weight bearing should be forbidden for another three weeks.

Bejal, as quoted by Sever,[2] believes that extension is an efficient method of treatment and that rest in bed for eight or ten weeks is necessary.

The syllabus[7] for outline of treatment of fractures advises that patient is to be kept supine in bed, the pelvis encircled by swathe and if necessary suspension in a Balkan frame. Kept in bed for four to twelve weeks and then a belt used. Active motion is begun in five to eight weeks.

Sever[2] himself summarizes the treatments of the pelvis as follows:

> In general, rest in bed, with a tight swathe is usually sufficient for comfort and fixation. The leg may be extended or flexed, as the comfort of the patient may indicate. A pelvic sling may make the nursing care easier, and in extensive fractures, may tend by its lateral compression, reinforced by body weight, to force the fragments together and hold them in position better . . . Traction on the leg combined with a pelvic swathe has been found useful in fractures extending thru the pubic arch, the sacroiliac joint and wing of the ilium on the same side with a dislocation upward of that side of the pelvis. The traction tends to reduce this dislocation and usually adds to comfort. Paralysis of the leg, not infrequently seen in these so-called Malgaigne fractures, is generally transient; that is, it is not permanent, and will clear up in anywhere from six weeks to one year.

Fractures with Displacement. Attempts should be made to correct the deformity. Wilson and Cochrane[6] say:

> In the event of wide gaping of the symphysis or of similar displacement in a fracture of the rami of the pubes, a broad canvas sling or hammock should be passed under the pelvis and low back, and the ends secured to the overhead beams of a Balkan frame. The pressure of the sling on the sides of the pelvis, from the weight of the patient's body, exerts a strong compressing force on the bones, which tends to push them together. With this apparatus the Bradford frame is unnecessary, and the nursing care is facilitated by suspending the ends of the hammock by means of weights and pulleys so that the patient may be lifted readily when this is necessary. The general comfort is promoted and the deformity more easily corrected if, at the same time, the legs are suspended in Cabot's posterior wire splints and counterpoised appropriately with weights and pulleys, in order to relieve the pelvis of the strain which their weight imposes.

Traction. Upward displacement of one of the pubic bones at the symphysis may be corrected by application of extension to both limbs either by weight and pulley or by Thomas Jones' braces.

Manipulative Reduction. According to Wilson and Cochrane:[6]

> Manipulative reduction is decidedly unsafe, but may be attempted on occasions when other methods fail, and particularly in the case of sacro-iliac luxation with displacement. In the latter type of injury, the manoeuvre consists

in flexing the leg at the hip with the knee extended and then making pressure posteriorly in the axis of the limb, while at the same time the other leg is held in the extended position, and lateral compression is applied to the sides of the pelvis. First one and then the other leg is manipulated, and the reduction may accompany either movement, depending upon the type of the displacement. Direct pressure and counterpressure upon the ilium and sacrum are also effective.

Such manipulative reduction never appealed to me personally. Rather am I in accord with Speed[3] that "Simple cases with no complications may be reduced by gentle manipulation or traction on a leg . . . If much force or mechanical extension is necessary to make reduction, the deformity should not be interfered with." In all our cases at Fordham we used only gentle manipulation and traction.

AFTER-TREATMENT

The extension of hammock suspension is kept up for two to three weeks. Then it is removed and more freedom of the legs permitted. The patient stays in bed for four to five weeks depending upon the type of fracture and the presence or absence of displacement. A well-fitted belt or corset is then used for several months. As a rule complete recovery is obtained in three or four months but men who have to do heavy work cannot resume their occupations before five or six months. (Table IX and X.)

TABLE IX

TREATMENTS

Bradford frame alone	2
Adhesive plaster strappings[1]	42
Plaster casts[1]	15
Operations	3
Patients died on admission or same day before treatments given	9
No treatments[2]	39

[1] Many of the patients who were strapped or had plaster casts were also on Bradford frames for the first few weeks.

[2] No treatments for 39 patients requires some explanation. If we subtract the number of patients who died immediately (9), only 30 are left. Of these, six or seven left before treatments were administered and the rest had such mild symptoms that treatments were not necessary.

TABLE X

RESULT ON LEAVING THE HOSPITAL

Improved	78
Not improved	2
Unknown	4
Died	16
Cause of Death:	
Pneumonia	3
Ruptured bladder	4
Died on admission or same day	9
Left at their own accord	7

CONCLUSIONS

1. Fractures of the pelvis are not as rare as was formerly supposed.

2. The fracture is almost always caused by great violence, falls from heights or crush between two moving objects. (The automobile is the most frequent offender.)

3. The diagnosis is comparatively easy if one carefully examines the irregular bones of the pelvis and ilium both inside and outside. The two ilia should be crowded gently but firmly together to determine crepitus. Vaginal and rectal examination should be included.

4. In uncomplicated cases, the prognosis is good. Union occurs in from eight to ten weeks. If the acetabulum is not involved the return to function is complete.

5. The patient can be up in six to seven weeks.

6. As a rule complete recovery is obtained in three or four months. Men who have to do heavy work cannot resume their occupations before five or six months.

7. Isolated fracture of the wing of the ilium rarely leads to disability.

8. Iliac fractures extending through to the top of the acetabulum, even when there is gross displacement, are not bound to give permanent disability.

9. Fractures of the rim of the pubis or of ischium are generally more severe in character, but rarely are permanently disabling. At the worst they are deforming to the pelvic outlet in women and except when they involve the tuberosity of the ischium, not eventually painful. (Sever.)

10. Treatment: Application of a Bradford frame and strapping of the pelvis is all that is necessary in the great majority of cases.

11. In incidents of fractures with displacements, a Balkan frame with a canvas sling under the pelvis is used.

Fig. 1. Case 1. Roentgenogram taken February 7, 1928, before reduction. Fracture of both rami on each side. Fracture of left os pubis.

12. It is inadvisable to use manipulative reduction.

ILLUSTRATIVE CASES [1]

Case 1. Nancy B., aged twenty-five, single, admitted January 27, 1928, discharged April 4, 1928. Was in an auto accident; sustained an injury to the pelvis. Was conscious when brought in. Complained of pain and tenderness in pelvis. No urinary disturbance.

Roentgenograms on January 27, 1928: Fracture of both rami of left pubis also body of the left os pubis with displacement. Fracture of both rami of right os pubis with displacement. The entire pelvic cavity is deformed and distorted. Right sacroiliac articulation is separated (Fig. 1).

February 7, 1928: Put on a Bradford frame and strapped back. Felt better immediately. Restrapped a few times. Taken off the frame in four weeks (Fig. 2). Kept in bed two weeks longer, then sat up. Within a week walked. Within one month was able to dance. Can now dance even such strenuous dances as the Charleston, black bottom and varsity drag.

Roentgenogram taken on November 2, 1928 (last one) shows good union between the fragments of the rami. The body of the pubis is still slightly separated but apparently gives her no trouble (Fig. 3).

[1] These cases are illustrative of the rapid recovery possible. They are very recent cases, not included in the report.

Case 11. Esther L., aged 14, admitted April 29, 1928, discharged June 23, 1928. While walking across the street was struck

Fig. 2. Case 1. Roentgenogram taken April 19, 1928 on discharge. Note callus present.

by a car. Was unconscious when brought to the hospital.

Was seen by me on May 5, 1928 and the following notes made: Patient cannot turn from side to side. Some tenderness at right

Fig. 3. Case 1. Roentgenogram taken November 2, 1928. Note good callus and good position.

sacroiliac joint. Flexion of flexed knee on abdomen produces spasm of the back. Extended knee is more painful. Right knee: flexion on abdomen produces no spasm.

Roentgenogram on May 5 showed a fracture of the superior ramus of right pubis. Displacement of pelvis to the left. Separation of symphysis pubis. The left os pubis is higher than the right (Fig. 4).

Treatment: Strapped back. Put patient on Bradford frame. Thomas Jones splint on left side in abduction. (Corrected the deformity.)

Roentgenogram on May 16 shows deformity corrected (Fig. 5).

Was on the frame about four weeks. When taken off sat up at once and in one week was strong enough to leave the hospital and return to the Out-Patient Department for treatments. Complete recovery in thirteen weeks.

Last roentgenogram taken on October 22 shows very good union of the right rami, no separation of the symphysis. The right pubis is a little lower than the left (Fig. 6).

Fig. 4. Case II. May 5, 1928. Fracture of superior ramus of right pubis. Displacement of pelvis to left. Separation of symphysis pubis. Left os pubis higher than right.

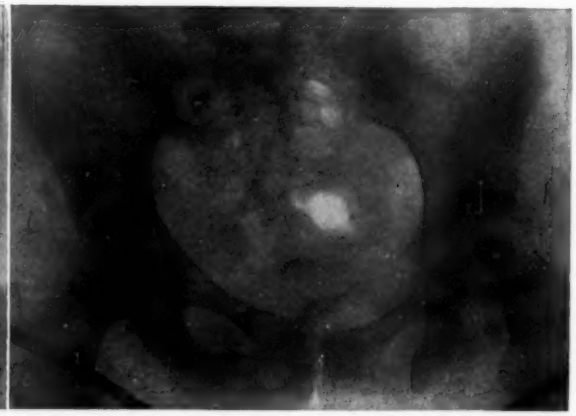

Fig. 5. Case II. May 16, 1928. After reduction. Note good position of pubis.

Case III. Samuel S., aged thirty-eight. On September 24, 1927 patient fell through an open space in a new building, landing on the left side on a plank. Was brought into a neighboring physician's office in shock. Recovered quickly and was transferred by him to a sanitarium where a roentgenogram was taken. I saw him a few hours later.

Patient complained of pain in the left hip. Kept both feet in good position. Tenderness at the left ischial tuberosity. (Flexion of the right extended knee on abdomen produces pain in the back.) Abduction of right side produced pain in the symphysis pubis. Motion of left hip produced pain especially to flexion and abduction. No shortening present.

Roentgenogram shows a fracture of left acetabulum and left superior ramus; slight displacement of the upper fragment upward.

Strapped back and pubis. Applied a Thomas-Jones splint in marked abduction.

Left hospital in two weeks. Massage commenced in three weeks. Was in bed for six weeks. Then commenced to walk.

When examined by me in January 1928 (four months later) had a very slight limp. At present walks without a limp. Motion of left hip free except to extreme abduction or extreme outward rotation. Is able to follow his occupation freely.

Fig. 6. Case II. Oct. 27, 1928. Good union. Good position.

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DISCUSSION

Dr. George F. Cahill (from the standpoint of the urologist): From the statistics presented by Dr. Boorstein, rupture of the bladder occurs in 6 per cent of fractures of the pelvis. In four years at Bellevue Hospital there occurred 16 cases of rupture of the bladder from trauma. Not all of these cases accompanied fracture of the pelvis. Fracture of the pelvis is most commonly due to a crushing injury. When the ramus of the pubis is broken, whether it may injure the bladder or not depends on the course taken by the sharp fractured end of the bone. Often with the crushing injury, the pelvis is rolled between two opposing surfaces and the entire arch forced inward in several planes. These cases are the ones in which severe visceral injuries occur with tremendous shock and hemorrhage, and the investigation is most always made by the medical examiner in his department, for few live long enough for roentgen-ray and surgery.

There are two types of rupture of the bladder: a bursting one and a perforating one. In the former the bladder is distended and there is no protective muscle spasm of the abdomen, either through intoxication, the most usual cause, or through trauma rendered while the subject is not on guard. The bursting, full bladder ruptures on the weakest point of the circumference opposite the pole of contact, similar to any bag of fluid. Rarely does this type accompany fracture of the pelvis. The perforating type of rupture is either from a fracture of the pelvis or from a perforating foreign body. The usual type is that in which the transverse arch of the pubis fractures close to the symphysis, and the sharp end is displaced upward and inward. In most of the radiographs shown by Dr. Boorstein the displacement of the ramus was downward, and in some outward; all without visceral injury.

The diagnosis of the ruptured bladder in its early stages is often difficult, but as a rule the patient is unable to void. The passage of clear normal urine in quantity, with a fractured pelvis can usually be taken as a contraindication of a rupture of the bladder. It may happen, but rarely, that a rupture due to a short sharp spicule does not empty the bladder sufficiently to prevent the patient from voiding, and in that case the voided urine will be blood tinged. Occasionally with a fracture of the pelvis, there may be coincidental injury to the kidney, but none to the bladder, and in this case marked hematuria will be present. Such cases require considerable care to rule out bladder injury. There is always tenderness over the fractured pelvis and this may interfere with determination of the amount of abdominal tenderness. Muscular protective rigidity comes later with the onset of irritation and infection.

Catheterization of these cases must be done with great care, first to prevent bleeding from the catheter and so confuse the diagnosis and, second, to prevent the introduction of infection. There is usually a small amount of dark bloody urine in the bladder. In rare cases manipulation of the catheter through an intraperitoneal rent in a burst bladder, will drain away an appreciable amount of fluid from the peritoneal cavity, and not from the bladder.

If cystoscopy is possible, observation of the rent in the mucosa is possible and the diagnosis is definite, but it is rare to be able to cystoscope these cases. Cystograms taken with air injection offer the safest means for making the diagnosis and to guard against infection.

All perforated bladders should be operated upon as soon as diagnosed. The suprapubic route is the only one. There is usually a marked infiltration of the pelvic tissues with blood and urine, and often it is hard to identify the outer surface of the bladder. The opening in the bladder should be closed from the peritoneal side, all hemorrhage controlled and the urine drained through a urethral retention catheter. If the fractured bone is exposed the drainage should be prevented, if possible, from crossing the fracture. These cases, if drained across the bone become infected and produce rapid destruction of bone. In 1927 at Bellevue Hospital a fractured pelvis with ruptured bladder drained suprapubically was followed by osteomyelitis of

the pubis and a destruction of the entire anterior pelvis. Similar cases occurred during the War from gunshot wounds and draining urine through the pelvic bone, caused a dissolution of the bone.

The mortality of fracture of the pelvis with rupture of the bladder is over 60 per cent. The cases die in three ways: first, in severe injuries, from shock and hemorrhage. Second, in less severe injuries, from acute, rapid pelvic infection. Third, those cases with infected bladders and osteomyelitis of the pubis, after a long illness, die of exhaustion. The simple, burst bladders without fracture, if treated early and properly, have about 90 per cent recoveries.

Dr. H. Finkelstein (from the standpoint of the orthopedist): I was especially impressed with the high mortality rate in these fractures, amounting to 16 per cent. This, of course, is due to the close proximity of important organs. One point to remember in this connection is that the patient should be very carefully handled during transportation to hospitals, to avoid unnecessary additional trauma. Internes should be carefully instructed to place the patient on a stretcher, with a pillow under the knees which should be strapped and the chest and pelvis securely bandaged to prevent motion.

One other point: injuries sufficiently severe to cause fracture of the pelvis may produce fractures elsewhere, such as the skull, spine and one or more extremities. Occasionally one fracture is treated and others overlooked.

Regarding the mechanics of pelvic fractures: The pelvis consists of two posterior arches known as the sacrofemoral arch and the ischiofemoral arch. These are very powerfully constructed and are held together by the weak anterior arch, consisting mainly of the pubic bones and the parts of the ischium. The integrity of the posterior arches depends upon the anterior arch remaining intact. With the solution of continuity of the anterior arch, the strain is brought to bear on the posterior arches. The anterior, or weak part of the pelvis, is the one that is invariably fractured or separated at the symphysis. Whether the force is from in front, behind, laterally or from below, invariably that portion of the true pelvis between the symphysis pubis and the acetabulum is broken. One almost never sees a true dislocation of the sacroiliac joint or a fracture of the ilium or sacrum in the vicinity of the sacroiliac joint without primary fracture or separation of the anterior ring of the pelvis.

Dr. Boorstein did not discuss the nerve symptoms which occur in fractures and dislocations of the pelvis. Where there is a fracture near the obturator foramen with displacement of the adjacent bones, pressure on the obturator nerve is an occasional symptom. This manifests itself by pain along the inner side of the thigh down to the knee. In dislocation of the sacroiliac joint, pain along the sciatic distribution is a very common symptom. In fracture of the sacrum, injury to the sacral plexis may result with pains along the distribution of its various segments.

In attempting to diagnose fractures or dislocations of the pelvis, rough manipulations should be avoided. There is nothing gained by forcibly compressing or separating the ilia, or by forcible pressure of the femur against the acetabulum. By means of gentle palpation, rectal and vaginal examinations sufficient important data can be obtained. At any event, the roentgenogram will decide the exact lesion in doubtful cases.

The prognosis in these fractures, when uncomplicated by visceral injuries, is exceedingly good. In treating a simple fracture without displacement, four weeks in bed and another four weeks' after-treatment is sufficient. Where there are bony displacements, eight to ten weeks is the minimum period. The disability may last from three to six months.

Dr. A. J. Rongy (from the standpoint of the obstetrician): I was much interested to hear what Dr. Finkelstein had to say about the anatomic construction of the pelvis and its relation to orthopedics.

From an obstetrical standpoint the human bony pelvis is certainly not ideally constructed.

You are probably aware that in the beginning of this century many women were delivered by the so-called pubiotomy operation. Cases, in which there was a disproportion between the fetal head and the pelvis and in whom infection was presupposed, were delivered by pubiotomy operation. Very often separation of the cut edges was further increased by the delivery of the fetal head with forceps. Up to 1917 there was about 1000 pubiotomies performed. I did 16 pubiotomy operations. In addition to that I saw 3 cases of traumatic fracture of the pelvis produced by forceps. Evidently the obstetrician

in these cases had used a great deal of force and did not understand the principles governing the delivery of the fetal head with forceps.

Now, these cases gave me an idea how fractures of the pelvis heal and of their subsequent history. I found that after five to six weeks' union had taken place and the patients could walk without any discomfort whatsoever. Many of these women became pregnant subsequently and, with the exception of 1 case, were delivered either spontaneously or with forceps. In 1 patient exostosis formed on the inner surface of the pubic bone, about the size of a silver dollar, but it was no obstacle to subsequent labors.

The fetal head is very malleable and it accommodates itself to the irregularities of the pelvis without much trouble.

The postoperative treatment of these cases was very simple. Our earlier cases were placed in a hammock in order to exert uniform pressure on the sides of the pelvis, but with further experience we found that this was not necessary and the severed bones were brought into a close proximity by strips of adhesive plaster applied to the sides of the pelvis across the abdomen. These patients were kept in bed about eighteen days; after that they were allowed to locomote beside the railing of the bed, and at the end of three weeks they were permitted to walk about the wards.

We never found any untoward effects as a result of the operation, except that, of course, occasionally the injury to the anterior vaginal wall was quite extensive and cystocele formed.

Dr. Boorstein (closing): About the mortality (16 per cent): 9 per cent of these were brought in near death. They had marked injury to the viscera; the entire viscera were exposed. We could not say that the death was due directly to fracture, but I would not say that we had more than 10 per cent. Some observers claim that the mortality in fractures of the pelvis is as high as 50 per cent. The injuries are not as severe and the mortality was not as high as we thought and as other people think.

Fracture of the pelvis is sometimes not recognized: We had several cases in the hospital who had separation of epiphysis and were in the hospital for three to four weeks without complaining in that region. The fracture of the pelvis was discovered accidently. Some of them we made the diagnosis after they left the hospital. They had no symptoms.

ACUTE INTESTINAL OBSTRUCTION*

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IN spite of the great advances made in medicine and surgery, intestinal obstruction remains one of the most serious conditions confronting the profession. The mortality of this condition continues to be appalling. The lowering of the death rate can come only by an early diagnosis and appropriate treatment. Experience has taught us that without the early recognition of the condition the resultant toxemia progresses so rapidly that even in cases where strangulation is not present, operative treatment is of no avail.

In acute intestinal obstruction a carefully taken history is of prime importance. In this connection, a careful inquiry should be made in regard to any previous abdominal operation, previous attack of appendicitis with or without operation, history of local or general peritonitis, history of any pelvic infection, abdominal injury, history of gall-stone colic, history similating rupture of a peptic ulcer, recurring attacks of pain such as may occur in intussusception, severe constipation, bloody bowel movements such as may occur in malignant tumors of the lower bowel, mesenteric thrombosis, etc. In case one is dealing with one of the groups of various hernias; inguinal, femoral, umbilical and ventral, there is usually a history of an existing hernia at one of these anatomical locations, and the hernial mass will be apparent from physical examination. Obstruction from this group, however, has become much more infrequent, because of the fact that these cases are now more frequently treated surgically before such accidents occur. Routinely, rectal and pelvic examinations are called for.

Intestinal obstruction may be due to lesions, such as volvulus, diaphragmatic hernia, intussusception, internal strangulation, foreign bodies, enteroliths, gall stones, intestinal parasites, bands, adhesions, kinks, twists, tumors; congenital defects, such as Meckel's diverticulum and megacolon; dynamic causes, such as lead poisoning; adynamic, such as embolism or thrombosis of the mesenteric vessels, general peritonitis, etc.

Whenever a patient who has previously been well develops sudden severe cramplike abdominal pain, intermittent in character, with nausea and reflex vomiting, obstipation, in the absence of fever, and gives a history of an abdominal operation, he should be looked upon as a case of acute intestinal obstruction.

The pain is the first symptom manifested. It is usually sudden in onset, colicky and spasmodic in character in the beginning, and later becomes continuous and more severe, particularly in cases of mechanical obstruction. Hiccough is a common but later symptom. Tenderness is practically always present, but varies with the character and location of the obstruction. Shock is an early manifestation and varies with the damage to the segment of bowel involved. Rapid pulse, subnormal temperature, cold sweats, dryness of the mouth, marked thirst, pallor, stercoraceous vomiting and high leucocyte count are late manifestations, and are evidences of marked toxemia and devitalized tissue. Acute intestinal obstruction more frequently involves the small intestines and the pain is likely to be general rather than localized, due to the fact that the nervous mechanism prevents localization of pain where the small bowel is involved. The pain, however, is more frequently referred to the mid-portion of the abdomen. The pain will vary as new complications arise.

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Constipation is present in all cases of complete obstruction. Many persons have been misled by the fact that one or more bowel movements had been noted and in some cases gas passed after the onset of the symptoms. This has been especially true where the obstruction was high up in the small intestine. The higher the seat of obstruction in the intestinal tract, the more likely are bowel movements to occur after obstructive symptoms manifest themselves, and the more severe the onset. Diaphragmatic pleurisy of a severe type, as a reflex phenomenon, causes a paralysis or an inhibition of peristalsis and may be mistaken for intestinal obstruction. In this condition, however, there is an elevation of temperature. A sudden suspension of peristalsis and inability to secure a bowel movement are also encountered in acute perforative appendicitis, acute perforative cholecystitis, perforation of gastric and duodenal ulcers, acute pancreatitis, etc. In these conditions, however, the rise in temperature, increased leucocyte count and the details of the history offer valuable information in making a differential diagnosis.

Distention is a later development. In very acute cases, such as intussusception and volvulus, especially where strangulation becomes a factor in rapidly interfering with circulation, distention develops much more rapidly. The lower the obstruction, the greater the distention, and the higher the obstruction the greater the vomiting. Rigidity of the abdominal muscles develops along with abdominal tenderness.

Eisberg emphasizes the importance of a study of the blood chemistry. He states that this is a great aid in questionable cases, and corroborative evidence in clearly defined cases. Dragstedt states that acute intestinal obstruction of the upper part of the small intestines leads to symptoms of a severe rapidly developing toxemia; that there is an associated characteristic change in the blood chemistry which is summarized as follows: A decrease in the concentration of chlorides, a late increase in non-protein nitrogen and urea, and an increase in the carbon dioxide combining power in the blood plasma.

In embolism of the mesenteric vessels there is sudden intense pain, sudden marked rise in the pulse rate, sudden shock, blood-stained diarrhea, and usually a history of some form of infection, such as endocarditis.

In the case of Littre's hernia, constrictions through slits in the omentum or mesentery, constrictions through the foramen of Winslow, or retroperitoneal hernias, one is not likely to be able to make a diagnosis by any other means than an exploration. Finney, in discussing the difficulty in arriving at a diagnosis in many cases, emphasized the fact that practically all of the conditions with which it is likely to be confused demand operation almost as imperatively as does intestinal obstruction.

In 1914 Dr. J. B. Murphy, in discussing acute intestinal obstruction, stated that the results in this field of surgery have not materially changed in thirty years, even with all the great recent advances in our knowledge of pathogenesis and symptomatology of disease, and with all the modern improvements in surgical technique.

Gibson, in 1900, collected a series of 1000 cases of intestinal obstruction, which showed an average mortality of 43.2 per cent. The Presbyterian Hospital series of 1089 cases, collected in 1925, showed a death rate of 41.8 per cent. In 1921, Finney collected and reported 245 cases. In this series, he showed that in the cases operated under twelve hours, the mortality was 5 per cent. Those running over a second twelve hours gave a mortality of 11 per cent, more than double the twelve-hour group. In those running twenty-four hours the mortality increased to 31 per cent.

Cubbins states that acute intestinal obstruction would be a relatively benign condition were it always diagnosed immediately and prompt surgical intervention instituted. The mortality is in direct

proportion to the time elapsing before operation is performed.

Acute intestinal obstruction due to kinking, may occur following shortly after a laparotomy and during peritonitis. The symptoms in such cases may be obscured by the administration of morphine hypodermically, and the complication erroneously called paralytic distention or ileus. Dr. John B. Deaver has long since emphasized the fact that symptoms of intestinal obstruction developing shortly after an abdominal operation should be promptly and thoroughly checked, and that if gastric lavage, enemata and pituitrin do not correct the symptoms within twenty-four hours the abdomen should be reopened. Dr. C. H. Mayo said that he had never seen a death occur as a result of an unnecessary exploration for intestinal obstruction, but that many patients died because exploration was not done.

The diagnosis of intestinal obstruction in its early stages is frequently obscure and difficult, but the prognosis is good. Late in the disease, on the other hand, the diagnosis presents practically no difficulties, but the prognosis is grave. By a careful review of the history of the case and a close study of the onset and symptoms one should be able to determine the presence or the absence of obstruction. Once a diagnosis of obstruction is made, immediate operation is called for. In case a decision cannot be reached as to whether or not there is an obstruction, one can at least decide early whether or not his patient has an emergency abdomen. When a decision has been reached that the patient has an emergency abdominal condition, the question of an immediate operation is settled and the patient's life saved.

In conclusion, I wish to emphasize the fact that in acute intestinal obstruction the patient's life is in the hands of the doctor who is first called, and that many a life has been sacrificed because prompt diagnosis has not been made and the proper treatment instituted, or else surgical treatment advised as a last resort. This gives rise to a procrastination mortality of 35 per cent or more.

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INTRAVENOUS INJECTIONS OF RIVANOL IN PUERPERAL SEPSIS*

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IN recent times the pendulum of therapeutic fashion has swung strongly against the use of chemical antiseptics by the intravenous route in the management of infections associated with the puerperal state. I am presenting only a small number of records taken from my series of about 150 cases. My clinical impressions show that, in the use of rivanol, we have an effective and valuable agent with which to combat infections. It is my hope that this report will stimulate others to try the method which I will outline for the use of rivanol in postpartum and postabortal sepsis, and also in other infections that are severe enough to overcome the natural barriers and to invade the blood stream. In this manner, we will soon be able to establish its proper valuation in the treatment of these maladies.

The very favorable effects of rivanol in the first cases on which I used it led me to continue its use and to check up its value scientifically by a series of alternate control cases.

During the spring of 1924, there was an unfortunate outbreak of an epidemic of puerperal infections. We looked for the cause, but without success. This epidemic gave me an opportunity to try out the value of rivanol in a series of cases. We therefore began to use it only on alternate cases.

Rivanol is a light yellow fine crystalline powder, also prepared in tablets of 0.1 gm., soluble in approximately 260 parts of water at 25°C. and 28 parts of hot water. The solutions are yellow and fluorescent, but darkness when exposed to light for several days. The aqueous solution is stable to boiling. The reaction to litmus is neutral.

The antiseptic power of rivanol in living tissue as described by Morgenroth is as follows: A dilution of 140,000 sterilized an experimental streptococcus which showed phlegm in a subcutaneous tissue of the mouse within twenty-four hours. In the test tube, streptococci were destroyed in the presence of serum by concentration of 1,100,000. The slight toxicity permits the use of large doses of the diluted concentration in man. Rivanol has proved to have a strong affinity toward the cocci group and has been used clinically as a tissue antiseptic in such cases as localized pyogenic abscesses, plural empyemas, peritonitis and joint infections. In this article, we are concerned only with its use as an antiseptic for the blood stream used intravenously for puerperal sepsis.

Rivanol is an acridine derivative (2 aethoxy-6-9-dianimo acridine) which has a strong affinity for parasites and has no affinity for the cells of the host with great antiseptic powers and very little toxicity.

We therefore began to use it only on those alternate cases diagnosed as puerperal sepsis which were admitted to the service of Dr. Pfeiffer at the Kings County Hospital. We did not classify a case as one of puerperal sepsis unless the temperature was 103°F. or over and a careful complete physical examination ruled out any other cause for the fever, the usual accepted temperatures of puerperal infections being 100.5°F. for forty-eight hours. We took the severer forms of sepsis. The control cases were treated symptomatically and with blood transfusion. Aside from the rivanol injections they were treated in no different manner from the others.

The results are tabulated in Figures 1 and 2. In this group, there were 7 rivanol treated cases and 9 controls. The 7 treated

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cases all recovered; of the 9 controls, 2 died. Both of the 2 fatal cases had received blood transfusions. The average

RIVANOL TREATED CASES Series I.

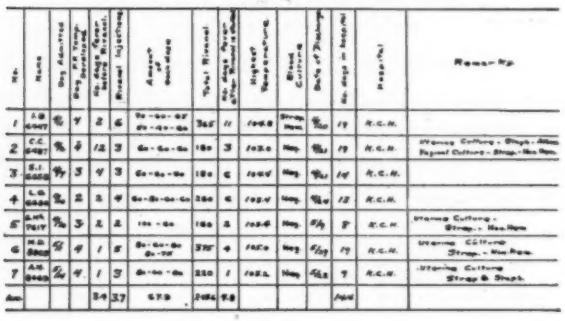

FIG. 1.

number of days of fever of the treated cases was 4.8; of the controls 13.3. The average stay in the hospital of the treated cases was 14.4, of the controls 23.3.

Case 2 of the treated group was first used as a control. When the patient

CASES TREATED WITHOUT RIVANOL Control Series

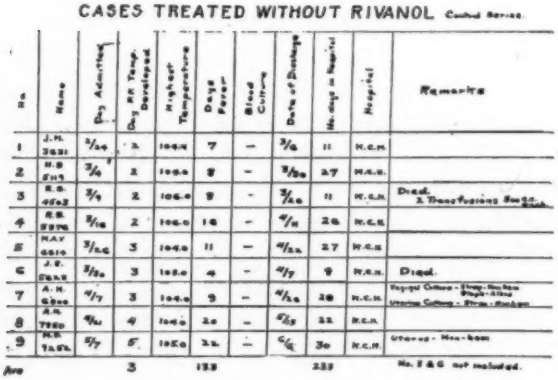

FIG. 2.

began to go rapidly down hill, rivanol was tried after twelve days of fever. She improved almost immediately and had a normal temperature in three days. The figures for the treated group would have been more favorable if this case had been left as a control.

Figure 3 includes 15 rivanol treated cases I have had since the controlled series. This series includes 3 cases of postabortal sepsis and 1 postoperative infection. Here the temperatures ranged from 102.8°F. (lowest) to 107°F. In this group, the average days of fever after rivanol was given was 4.8. The average stay in the hospital was 16.9. There were no deaths in this group. The average

RIVANOL TREATED CASES Series II.

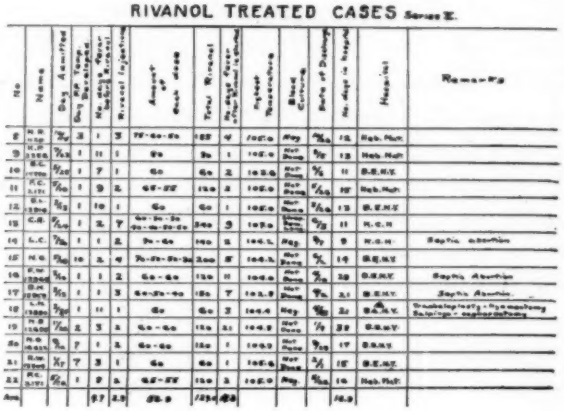

FIG. 3.

of all the 22 rivanol treated cases are as follows:

Average number of days of fever before rivanol was started	4.3
Average number of rivanol injections	2.8
Average number of days of fever after rivanol was begun	4.8
Average number of days in hospital	16.9

A tablet of 0.1 gm. when dissolved in 100 c.c. boiling water gives a 1:1000 solution. This was the concentration used in all my cases. Three-tenths gram of sugar as added to each 100 c.c. Ordinary tap water can be used, thus making the administration a very simple procedure which can be performed even in the patient's home. Sixty to 80 c.c. of 1:1000 solution is warmed to body temperature and injected very slowly; at least twenty-five minutes should be taken for the administration of the fluid. Care must be taken to keep the needle in the vein, as the fluid is irritating to the subcutaneous tissues. If the subcutaneous tissues are infiltrated, pain and swelling for several days of the arm will result, but no abscess has resulted from this cause. The same vein can be used more than once without thrombosis.

The largest single dose any of the patients received was 100 c.c., the smallest 40, the average 60.6. The number of

injections range from 1 to 7 with 2.8 the average. The largest total dose of rivanol any patient received was 375 c.c., the

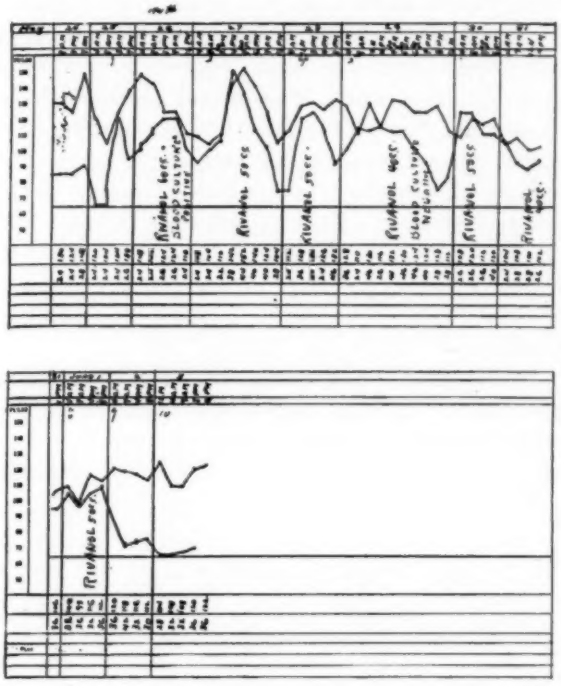

Fig. 4.

smallest dose 60, the average per patient 160.9 c.c. The injections can be repeated daily if necessary. I have never noticed any chill, rise in temperature, renal irritation, or any other undesirable effects from the use of rivanol in this manner.

The clinical effect of an injection is very striking. The temperature drops as by crisis within twenty-four hours. If it subsequently rises, the peak is lower than before. A second injection sends the temperature down to normal, where it usually remains. It is only rarely that more than 2 doses are required. With the drop in temperature, the general condition of the patient improves. Where a positive blood culture has been obtained, the effect of rivanol is to render the blood sterile so that usually after the second or certainly after the third injection, a positive blood culture can no longer be demonstrated. Whether this is the direct bactericidal effect of the rivanol, or the result of a mobilization of the body's defensive tissues and fluids, must be determined by more detailed and extensive experimentation.

By a review of some of the case histories

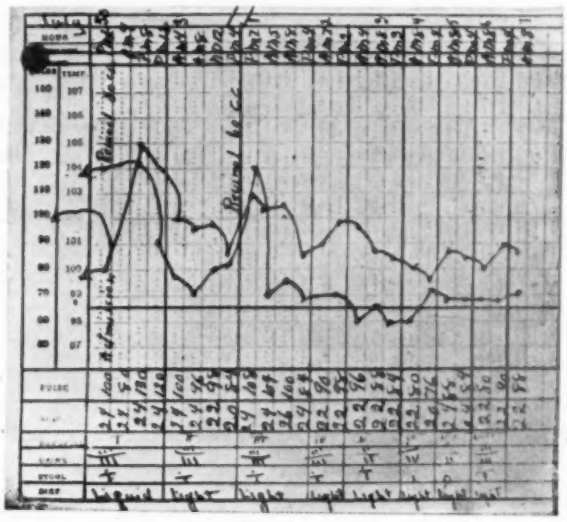

Fig. 5.

and fever charts one can get a more striking impression of the value of rivanol:

Case 1. C. R. Para 3, gravida 3.

Patient admitted to the Kings County Hospital at 2.30 A.M. on May 24, 1924, having been in active labor for three days. A midwife had attempted to deliver outside the hospital. Membranes were ruptured. Examination showed a right occipitoposterior position, head partially engaged. Cervix was very edematous and fully dilated. Forceps was applied and living child delivered. Placenta and membranes delivered spontaneously, moderate hemorrhage, no lacerations.

One day post partum the patient had a severe chill followed by a rise of temperature to 104°F. She was given supportive treatment. Two days post partum temperature continued 104°F. Blood culture was taken and 50 c.c. of rivanol given intravenously. Blood culture returned within twelve hours was positive for Streptococcus longus hemolyticus. Blood count: 28,000 W.B.C. with 85 per cent polymorphonuclear leucocytes; R.B.C. 4,176,000, hemoglobin 70 per cent. Patient received 50 c.c. rivanol daily for seven consecutive days. Blood culture continued positive for two days after the beginning of injections of rivanol, after which no growth was reported. Blood count on May 1924: 24,800 W.B.C. with 89 per cent polymorphonuclear leucocytes; R.B.C. 3,812,000,

hemoglobin 60 per cent. Urine negative. Patient recovered and was discharged with an exudate in left fornix.

After each rivanol injection, there was a characteristic drop in temperature. On the ninth day post partum, after the 7 rivanol injections, the temperature remained normal.

Case II. S. M., chart 7617, admitted to the Kings County Hospital April 30, 1925; gravida 4. Breech birth at first delivery. Repair of perineum after last delivery. Pelvic measurements ample. Blood pressure 120/80. Delivered spontaneously, right occipitoanterior, no vaginal sexaminations. Placenta expelled intact spontaneously, no lacerations. Entire labor four hours. On the third day post partum, patient had a chill lasting fifteen minutes and temperature rose to 103.4°F. 100 c.c. of rivanol were given intravenously. The temperature dropped to 100.4°F. with a corresponding improvement in the patient's general condition. The next day, 60 c.c. rivanol were given. The temperature came down to normal and remained there. The blood culture in this case was always sterile. The blood count at the height of the fever was: R.B.C. 4,600,000, H.G.B. 85 per cent; W.B.C. 18,400, 87 per cent polymorphonuclear leucocytes. Culture from uterus showed Staphylococcus albus and Streptococcus hemolyticus. Patient was discharged May 9, 1925 with pelvis entirely normal, having received a total of 160 c.c. rivanol.

In this case we have succeeded in practically aborting a case of sepsis by instituting the initial maximum dose of 100 c.c.

SURGICAL REPAIR OF INJURIES OF THE PELVIC FLOOR*

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INJURIES of the pelvic floor are usually the result of the trauma of labor. External violence may very rarely cause a severe laceration of the perineum. This, in my experience, has occurred twice and was found in children seven years old. In both instances a complete tear of the perineum resulted; from falling on a picket fence in one case and from rape in the other.

The injuries of childbirth are numerous and are of interest to the general practitioner of medicine, who delivers the largest number of women, to the obstetric specialist, to the general surgeon and to the gynecologist.

For purposes of treatment the lacerations of childbirth are divided into two distinct groups: first, the recent injuries, and second, the old lacerations.

RECENT INJURIES AND THEIR REPAIR

Lacerations at the time of delivery are classified as first degree when the tear involves the vaginal mucous membrane; second degree when it involves the vaginal mucous membrane and the levatores ani muscles, and third degree when it involves the vaginal mucous membrane, the levatores ani muscles, the sphincter ani and frequently the anterior rectal wall. The first-degree laceration, if left alone, may and usually does heal perfectly and leaves no after-effects. The second-degree tear demands repair to avoid the formation of a future rectocele. This can be done at the time of delivery, either before or after the expulsion of the placenta while the patient is still under the influence of anesthesia. The edges of the laceration should be exposed by means of proper retraction; the Gelpi or Bland perineal retractors being useful instruments for this purpose. It may be necessary to pack the vagina with sterile or iodoform gauze to keep the field dry. The different layers are then approximated by interrupted sutures of chromic catgut. In this form of repair the external perineum may be finished with chromic catgut or silkworm gut, my own preference being for catgut as there generally is satisfactory healing and no sutures have to be removed at a later date, a source of greater comfort to the patient.

The so-called intermediate repair of the perineum has been advocated, from time to time, by several gynecologists. While this is a satisfactory method of operating it has never gained much ground because so many of the patients are unwilling to be again anesthetized ten or more days after labor and to stay hospitalized for the extra number of days which this procedure makes necessary. Here the granulation tissue is curetted from the torn edges and the approximation of the severed tissues is carried out as it is in a primary or immediate repair.

INCISIONS OF THE PERINEUM

Third-degree lacerations of the perineum usually follow difficult or instrumental deliveries such as high forceps, version and breech extraction. That these extensive injuries are avoidable, in most instances, has been proved in all the well-conducted obstetrical clinics. To prevent this accident, two prophylactic measures are in common use; first, incisions of the perineum, and second, manual dilatation of the pelvic floor. There are two types of incisions recommended. The first is the median, which is referred to as a perineotomy and which gives excellent results where a moderate amount of

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room is required. This incision, which may be extended around the anus on one side or the other if more room is required, saves the sphincter ani from injury. It should not be used when the head has to be delivered far backward to clear the symphysis as in flat and funnel pelves. The reconstruction of the pelvic floor following this incision is simple, the vaginal part of the incision is closed with interrupted sutures of chromic catgut, the cut levatores ani are approximated with similar sutures, while the external perineum may be finished with catgut using interrupted sutures or a subcuticular stitch as one may prefer. The end result is very satisfactory both from the anatomical and the functional points of view.

The lateral incision or episiotomy is done on the side on which the occiput points, in other words, on the left side in left occipito positions and on the right side in right occipito positions. Very rarely is it necessary to make an incision on both sides. The episiotomy gives a great deal of room through which the head may be delivered and the sphincter ani can be preserved intact. The suturing should be accomplished by interrupted sutures of chromic catgut in the vagina and the muscle; my own experience has taught me that it is better to close the external perineum with silkworm gut, if the incision is extensive, as there is frequently a great deal of tension in this region and catgut may not give long enough support for proper healing to take place.

MANUAL DILATATION OF THE PERINEUM

Manual dilatation of the perineum is a method which obstetricians have used for many years. More recently Potter has advocated this procedure which he has refined in many of its details, and to which he gave the name of "ironing the perineum." This consists of a slow, gradual and systematic dilatation of the vagina and perineum. The procedure has proved satisfactory especially before the performance of a version and a breech extraction and has saved a large number of women from extensive lacerations of the pelvic floor. Potter has emphasized the fact that the dilatation should be accomplished slowly and gently to avoid tearing the tissues. The follow-up of patients so treated has proved to my satisfaction and to that of others that very few rectoceles occur following this method when it has been properly carried out.

If a third-degree laceration should occur during delivery, it should be repaired after the expulsion of the placenta. A large number will heal by first intention if the sutures are not tied too tightly to allow for the edema which follows the trauma of labor. Should the repair prove unsatisfactory, a secondary operation has to be attempted, preferably three or more months after the initial injury when the edema has subsided and scar tissue has formed between the torn edges. The immediate repair of a complete primary laceration of the perineum consists in suturing the anterior rectal wall, the sphincter ends, the levatores ani muscles, the posterior vaginal wall and the external perineum.

SECONDARY REPAIR OF OLD INJURIES OF THE PELVIC FLOOR

The old injuries of the pelvic floor with which the surgeon or gynecologist has to deal may be conveniently classified as incomplete or complete: incomplete when the sphincter ani and anterior rectal wall are not involved and complete when the opposite is true. There are two distinct complications which have to be met in this class of lesions; a rectocele or prolapse of the rectum and a posterior vaginal enterocele or prolapse of the cul-de-sac of Douglas. The overlooking of this last lesion, which is a true hernia with omental or intestinal contents or both, is responsible for a large number of failures of operations on the posterior vaginal segment. When left unrepaired the hernial sac and its contents may

roll out over the freshly reconstructed perineum as the patient assumes the upright position, causing her to feel that she has received no benefit from her operation.

The slight injuries to the perineum need no surgical intervention; all the extensive lacerations should be repaired, to add to the woman's comfort on the one hand and to prevent prolapse of the pelvic structures on the other.

Occasionally one meets a condition called the relaxed vaginal outlet. In this instance there is no apparent external tear, but the levatores ani muscles have been separated and the pelvic fascia had been torn and stretched under the intact mucous membrane and skin. On examination no apparent external defect is observed, yet the vaginal orifice may admit the five fingers of the examining hand and there is complete loss of support with early rectocele formation. This type of perineum needs surgical attention as well as the lacerated one.

Many operations have been devised to repair a damaged pelvic floor and opinions are still widely divided as to the best method of overcoming this condition. As a general consideration a lacerated perineum with its resultant rectocele should be looked upon as a definite hernia and the principles governing a hernial operation, which consist in the removal of the sac and the closure of the defect by means of available muscular and fascial structures, should be employed. Because they could not meet these conditions the superficial types of mucous membrane denudations by means of specially constructed scissors have been given up by most surgeons and have been replaced by flap-splitting operations by means of which the important supportive structures are readily exposed.

For a number of years, I have employed, in the Gynecological and Obstetrical Service of the Carney Hospital, a method which has given satisfactory results and the steps of which follow.

TECHNIQUE OF OPERATION FOR INCOMPLETE LACERATION OF THE PERINEUM

A Gelpi or a Bland self-retaining retractor is introduced, the points entering the tissues just below the ducts of the vulvovaginal glands, the high point of the rectocele is grasped, in the median line, by an Allis forceps, while posteriorly a similar instrument picks up the mucocutaneous border, also in the median line. The pelvic floor is opened by an incision extending from the point below the right duct of Bartholin to the posterior Allis forceps and then extending upward to the point below the duct of the vulvovaginal gland on the left. The anterior edge of the incision is picked up with tooth forceps, and sharp-pointed scissors are introduced between the rectal fascia and the rectum, the separation is carried upward to the crest of the rectocele, when the scissors are opened and withdrawn. The fascia and the overlying mucosa are now incised in the median line with straight uterine scissors and the flaps are separated laterally exposing the rectum and the cul-de-sac of Douglas above, and the pelvic slings below. The excess of posterior vaginal wall is cut away, thus leaving a diamond-shaped area of denudation. If an enterocele is present the dissection is carried up to the cervix, the cul-de-sac is opened, dissected free on all sides and removed as a hernial sac, the base of the sac is tied and the hernial opening is closed by suturing the sacrouterine ligaments together, from side to side.

In the absence of an enterocele the prolapsed rectum is sutured to the upper angle of the vaginal denudation by means of a mattress suture of chromic catgut. The upper part of the vaginal incision is now closed by interrupted chromic catgut sutures, each one picking up mucosa and fascia, until the upper edges of the levatores ani are reached. These muscles, covered by their fascia, are approximated in the median line, in front of the rectum, by means of three interrupted catgut sutures, the triangular ligament is approxi-

mated by a continuous stitch of fine chromic catgut, and the external perineum is closed by a subcuticular stitch of the same material.

COMPLETE LACERATIONS OF THE PERINEUM AND THEIR SECONDARY REPAIR

While lacerations of the perineum through the anal sphincter and the rectum are seen less frequently than they were a decade ago, because of the general improvement in obstetric practice and also because of the employment of the prophylactic measures already enumerated, they are still encountered. In the past eleven years, I have operated on 44 patients so afflicted. This lesion demands a careful dissection of the parts together with the approximation of the various layers without tension. The results are usually satisfactory, my personal series bearing witness to this fact, inasmuch as all the patients obtained satisfactory sphincter control and were relieved of their symptoms.

TECHNIQUE OF OPERATION FOR COMPLETE LACERATION OF THE PERINEUM

The pelvic floor is opened by an H-shaped incision. The lateral incision, on each side, extends from a point below the duct of the vulvovaginal gland to the retracted end of the sphincter. The transverse incision joins the two lateral by running through the edge of the scar tissue uniting the rectal and vaginal walls. A flap of posterior vaginal wall is raised exposing the rectum which is separated from the levatores ani muscles by blunt dissection. The anterior rectal wall is picked up by an Allis forceps, at the upper angle of the laceration and put on stretch; the torn edges are united by interrupted sutures of linen thread, the knots being tied within the bowel lumen. The perirectal tissues are approximated over the first suture line by a continuous mattress suture of No. 0 chromic catgut. The perirectal tissues are further approximated by figure-of-eight sutures of the same material. The rectal wound is thus closed in three layers. The torn ends of the sphincter ani muscles are dissected out of their bed of scar tissue and united with a figure-of-eight suture of No. 1 chromic catgut. The excess of the vaginal flap is resected, the edges of the vaginal incision are united with interrupted sutures of No. 2 chromic catgut, and the levatores ani muscles, covered by their fascia, are brought together by three interrupted sutures of the same catgut. The external perineum is closed by interrupted sutures of No. 2 chromic catgut, which in their course pick up the united levatores ani muscles to obliterate dead space. A subcuticular stitch may be substituted for the interrupted sutures.

AFTER-CARE

Two methods are in common use for the after-care of these operative cases: the dry method, where the parts are kept clean, sometimes powdered with a mild antiseptic powder and where no douches are given; and the wet method, where short vaginal douches are ordered to remove the vaginal secretions which are sometimes abundant. I have found, after trying the two methods, that the wet one gave me better results in all cases where it could be employed. Obviously, it is contraindicated if a vaginal hysterectomy has preceded the perineal repair.

Following operations for incomplete laceration, the patient is given, after forty-eight hours, a short sterile douche, about 1000 c.c. in amount, of boric acid or chlorazene solution, morning and night during her stay in the hospital, a rubber or a small glass catheter being used as a tip so as not to injure the parts. The bowels are moved after the second day by the administration of a mild cathartic or by enemata. By the fifth day, the patient receives a fairly generous diet and house diet by the seventh; she is given a head rest on the tenth postoperative day and she is allowed out of bed on the twelfth day.

For the complete laceration cases, the diet consists for the first five days of the white of an egg, an ounce of strained orange juice and enough water to fill a glass. This is given every three hours during the day and at the same intervals at night if the patient is awake. Between these hours she is given as much water as she cares to take. On the sixth day, a cup of beef tea or strained broth is substituted for the albumin mixture. The morning of the seventh day, she is given 1 ounce of castor oil by mouth, *half an hour later*, 6 ounces of warm sweet oil is gently instilled in the rectum, she is given a low suds enema when the desire to empty the bowel becomes apparent and she is instructed not to strain. After this a soft diet is allowed and by the ninth day she is on a full diet. A short vaginal douche as described above is given morning and night after forty-eight hours. Catheterization of the bladder is resorted to every twelve hours if the patient does not void readily.

STATISTICS

In looking over my personal records for a period of about eleven years, I found that I had done the following operations on the perineum:

Primary repair	322
Perineotomy	29
Episiotomy	95
Operation for incomplete laceration	440
Operation for complete laceration	44
Operation for hernia of the culdesac of Douglas	
Vaginal	9
Abdominal	7
Total	946

This series, small though it may be, is nevertheless large enough to prove or disprove the efficacy of a method. By following the technique already outlined the end-results have been uniformly satisfactory. The operations on the perineum were seldom done alone but followed operative procedures on the cervix and on the anterior vaginal wall in most instances.

CONCLUSIONS

1. Injuries of the pelvic floor should be repaired immediately after labor, since practically all of them heal by first intention, as a result of which the patient is saved from a second anesthesia and a secondary repair.

2. In order to avoid a tear through the sphincter ani and the anterior rectal wall, one of three methods should be employed at the time of delivery, namely: perineotomy, episiotomy and manual dilatation of the perineum and vagina.

3. Perineotomy, or median perineal incision, is recommended when the disproportion between the presenting part and the vaginal outlet is not too great.

4. Episiotomy, or lateral perineal incision, should be resorted to when a great deal of room is required as in difficult forceps operations.

5. Manual dilatation of the perineum and vagina is an ideal method of preparing the birth canal before version and extraction operations.

6. A technique is given for the secondary repair of incomplete and of complete lacerations of the perineum.

7. A hernia of the cul-de-sac of Douglas or posterior vaginal enterocele should receive adequate surgical treatment at the time the perineum is repaired to avoid recurrences in the posterior vaginal segment.

8. A carefully planned and executed after-care is essential in all cases to obtain satisfactory end-results.

THE ROENTGEN-RAY DIAGNOSIS OF ACUTE INTESTINAL OBSTRUCTION*

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NEXT to appendicitis, intestinal obstruction is the most common emergency encountered on the general surgical service of the Los Angeles County General Hospital. The mortality is between 40 and 50 per cent, which is consistent with the statistics of other similar institutions. This very high mortality is particularly unfortunate when we realize that the pathology in most cases of intestinal obstruction can be corrected by relatively simple surgical procedure, and if the diagnosis could be established and the treatment instituted within the first few hours of the disease rather than within the first few days, the mortality could be made comparable to that of acute appendicitis.

The big problem in intestinal obstruction is unquestionably one of earlier diagnosis. Our conception of the disease has too long been based on a clinical picture drawn from its terminal stages and not from its earliest manifestations. Even Cope, in his excellent monograph "The Early Diagnosis of the Acute Abdomen," mentions fecal vomiting as a point for differential diagnosis when considering intestinal obstruction, and yet we know that fecal vomiting is a symptom of obstruction of many hours' standing and is extremely grave in its prognostic significance.

In attempting to reduce the mortality, then, we must certainly direct our efforts toward earlier diagnosis, and anything that shows promise along that line commands our earnest consideration.

The use of the flat roentgen-ray plate in the diagnosis of intestinal obstruction was first suggested by Case in 1914.[1] He laid especial emphasis on the value of this procedure in recognizing postoperative ileus requiring reoperation. Since that time he has published several reports of further observations on the same subject, his most recent report[2] including a review of the literature which indicated that the method was being adopted at other clinics, and was proving itself to be a valuable diagnostic aid in dealing with this common abdominal emergency.

Kenneth Davis, of St. Vincent's Hospital in Los Angeles, took up the idea about three years ago, and as a result of his observations the present study was made at the Los Angeles County General Hospital where the material is much more plentiful than in a private institution.

The technique is very simple, the picture consisting of an ordinary flat plate of the abdomen. No preparation is necessary. It is always well, however, to administer an enema first to clear the lower bowel of gas. If the patient is very ill, a portable bedside instrument may be used. The film is developed at once, and can be read as a wet plate in about fifteen minutes.

The diagnosis of obstruction is based on the character and distribution of gas shadows on the bowel, and that will be best explained in conjunction with the pictures. The interpretation of the films, however, demands correlation with the clinical facts, and a positive diagnosis can seldom, if ever, be made on the roentgenogram alone. It would be a dangerous practice indeed to depend on the roentgenologists entirely for the diagnosis of intestinal obstruction, because he can no more make a positive diagnosis on his findings alone than the pathologist can make a

[1] Case, J. T. X-ray Examination of the Alimentary Tract. Troy, N. Y., Southworth, 1914.

[2] Case, J. T. Roentgenological aid in the diagnosis of ileus. *Am. J. Roentgenol. & Rad. Therap.*, 19:413, 1928.

* Read before the Los Angeles Surgical Society, November 16, 1928.

positive diagnosis from the white blood count. As a link in the chain of evidence, however, it is proving to be a wonderful diagnostic aid and is now routine procedure at the General Hospital whenever intestinal obstruction is considered as a diagnostic possibility.

Fig. 1. Normal abdomen containing more than ordinary amount of gas in bowel. Shadow of transverse colon distinct in outline but showing no evidence of distention. Irregular areas of gas in small bowel. (Right side of picture corresponds to right side of patient. This also applies in Figs. 2, 3 and 4.)

Fig. 2. Case of complete obstruction in sigmoid. Note tremendous dilatation of cecum and abrupt termination of gas shadow in sigmoid. Dilated loops of small bowel also visible.

Thus far we have been unable in all cases to differentiate from the films a mechanical ileus from the so-called paralytic ileus. It is therefore very important that the surgeon examine the pictures himself so that he can analyze the shadows with the clinical facts in mind.

Figure 1 illustrates a normal abdomen which happens to show a great deal of gas in the bowel. The gas shadow of the stomach can be seen high in the left upper quadrant, and the outline of the colon is almost as clear in this case as if it were filled with barium. The shadows cast by gas in the small bowel are scattered irregularly throughout the center of the picture. There is no evidence of distention of either the small or the large bowel, however, and no indication of obstruction. By comparing this picture with those that follow the evidences of bowel obstruction will become more clear.

Figure 2 illustrates a case in which the large bowel is completely obstructed in the region of the sigmoid. The haustral markings are visible identifying the loop as one of large bowel, but the markings do not go all the way across the bowel and the distance between the markings is lengthened. The diameter is considerably enlarged and the gas shadow stops abruptly in the left lower quadrant. The cecum is enormously dilated. With this plate, together with the clinical picture, we were able to make not only a positive diagnosis of intestinal obstruction but were also able to state definitely that it was in the sigmoid, and could plan our surgical attack accordingly. The patient was put to no discomfort, no opaque mixture had to be introduced into the bowel, and only a few minutes were consumed.

Figure 3 shows the type of shadow we get in small bowel obstruction. The loops are considerably different from those in

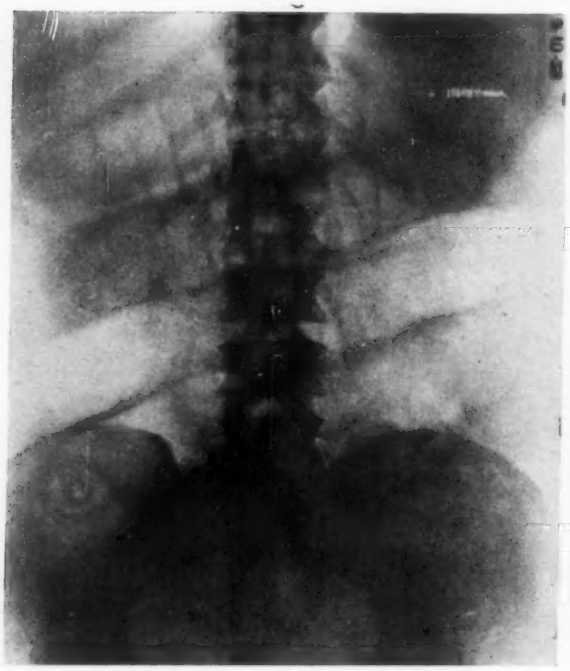

Fig. 3. Acute obstruction in small bowel. Note characteristic piling-up of loops and transverse marking caused by folds of Kerkring. No large bowel shadows visible.

Figure 2. The parallel lines crossing the bowel transversely are characteristic of small bowel. They are close together, they go all the way across the bowel, and can readily be differentiated from the haustral markings of the large bowel. They give to the loop what Case described as a "herring-bone appearance," and he states that they are due to the folds of Kerkring standing out as the rest of the bowel wall is thinned by the gas pressure. The piling up of the loops in ladder fashion as shown in Figure 3 is pathognomonic of small bowel obstruction. In early cases, however, this does not occur, and the diagnosis of small bowel obstruction then depends on the recognition of the "herring-bone" pattern. Only a small loop exhibiting this distention is very often sufficient to throw the weight of evidence in favor of operation.

Figure 4 is shown to illustrate the type of shadows which we see in cases of abdominal distention due to extra-abdominal causes, such as fractures of the spine, femur or ribs, ureteral calculi, pneumonia, etc. The gas here is seen to be

Fig. 4. Case of abdominal distention accompanying attack of renal colic. Irregular distribution of gas in both large and small bowel without characteristically distended loops.

in irregular blotches. There are no columns of gas under tension exhibiting the characteristics of either large or small bowel obstruction. This picture was made from a patient who was passing a kidney stone.

In our collection of 125 cases we have two pictures which show practically no gas shadows at all. In both of these cases there was complete intestinal obstruction with gangrene of the bowel. The obstruction which results in early gangrene may cause very little distention and this type of case must always be borne in mind. When the roentgen-ray findings are negative we are guided entirely by clinical findings in determining whether or not to operate. The greatest value of the flat plate is its positive value. When it is positive it corroborates a clinical impression and not only gives the surgeon a solid basis for urging immediate operation, but has a marvelous effect in convincing the patient that it is necessary. When the picture is negative we must be very careful about electing not to operate.

SUPERIOR LARYNGEAL NERVE BLOCK ANESTHESIA VIA THE PYRIFORM SINUS IN TUBERCULOSIS OF THE LARYNX

FURTHER EXPERIENCE WITH THIS METHOD IN TREATMENT OF DYSPHAGIA*

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SEVERAL methods are advised for the treatment of dysphagia in tuberculosis of the larynx. In cases in which general treatment does not improve the laryngeal condition, and in; which the dysphagia is so severe as to prevent swallowing, local treatment is of paramount importance. This is especially true in those cases in which patients dare not eat on account of the intense suffering.

Among the various methods used to lessen the pain, such as the direct radiation of the diseased parts with quartz or carbon arc lights, the electric cautery, roentgen ray, resection of the superior laryngeal nerve, and the injection with alcohol of the nerve according to Hoffmann's method,[1] the latter method is still of considerable value and importance. Although the paralysis of the sensory nerve of the larynx by means of Hoffmann's method is successful in many cases, not every one is satisfactory, and repeated external injections result often in failure or only partial success.

In 1912, Aurelius Rethi[2] proposed a simple method that could be used to reach and block the trunk of the nerve. This is by way of the membrane of the pyriform sinus, where the superior laryngeal nerve is quite superficial under the mucous membrane. At the close of his publication, Rethi speaks quite briefly of intralaryngeal division of the superior laryngeal nerve by means of Galvanocautery. On account of possible hemorrhage from the superior laryngeal artery this procedure is not without danger, and, as far as writer knows, it has never been used.

In dysphagia due to laryngeal tuberculosis Hutter[3] was the first who advised alcohol injections into the superior laryngeal nerve through the pyriform sinus. His attempt resulted in only a short relief to the patient, the freedom from pain lasting only half a day. Gustav Hofer of Hajek's Clinic in Vienna communicated to me that he successfully blocked the nerve in 3 cases of tuberculosis of the larynx with alcohol injections through the pyriform sinus, having used a needle of his own design.

Except for Hutter and Hofer, no one has used this method on patients with tuberculosis of the larynx. One has to bear in mind, however, that relatively few cases of laryngeal tuberculosis with dysphagia come to the attention of the average laryngologist.

I have taken an especial interest in developing this method, and employed it in 10 cases to date with good results.

A more detailed anatomy of the laryngeal area in question is necessary for a better understanding of the method. The three illustrations are given here, owing to the fact that good illustrations of the pyriform sinus and, especially, of the course that the superior laryngeal nerve takes through the sinus, cannot be found in anatomical textbooks. A good description of the sinus is given in Zuckerkandl's "Textbook of Anatomy:"

> In the upper half of the sinus pyriformis, there is often noticed a transverse fold running through the fossa (plica nervi laryngei Hyrtl) in which the laryngeal nerve is enclosed. If the parts are not congested, the nerve will show through. The section between the plica nervi laryngei and the plica pharyngo-

* Submitted for publication April 19, 1929.

epiglottica of the sinus is shallower than the lower portion of the same.

The superior laryngeal nerve in its course through the pyriform sinus is found below the pharyngoepiglottic fold and therefore the site of injection is to be sought in this area. The trunk of the nerve may be seen through the mucous membrane in greatly emaciated individuals.

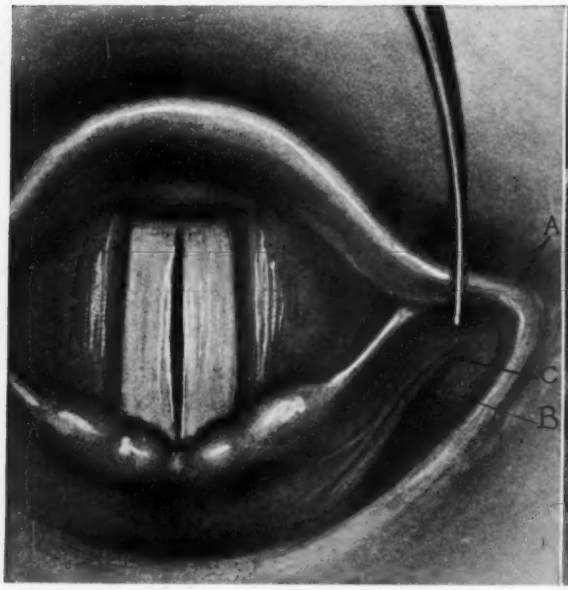

FIG. 1. Unusually distinct picture of pyriform sinus of highly emaciated tuberculous patient. Probe points to site of injection. A, Plica pharyngo-epiglottica. B, Aryepiglottic fold. C, Superior laryngeal nerve.

Figure 1 represents the findings in a markedly emaciated tubercular person. With the laryngeal mirror the nerve and its course through the pyriform sinus was distinctly visible. The sinus was, however, unusually shallow and broad in this case, and only for this reason were the details so easily viewed. Granted that such a clear picture is unusual, the illustration is nevertheless given to demonstrate the method better.

In Figure 2 likewise the pyriform sinus is relatively large but only a small part of the fold of the laryngeal nerve may be seen just below the pharyngo-epiglottic fold. It is quite plain, as in Figure 1, that the pyriform sinus is divided into two parts, a more shallow part, which so to speak, forms an upper level, and a deeper part, which forms a lower level.

Figure 3 shows the pyriform sinus as it would appear in the average patient. Here the aryepiglottic fold overlaps a part of the sinus, so that, in most cases, nothing may be seen of the fold of the laryngeal nerve.

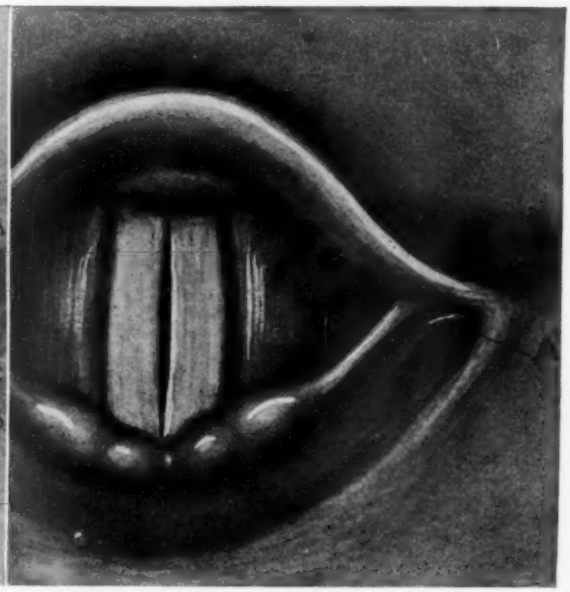

FIG. 2. A. Superior laryngeal nerve.

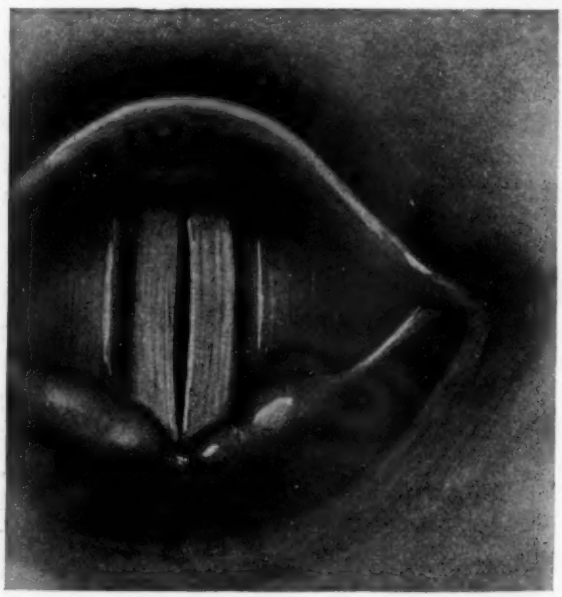

FIG. 3.

Careful observation of many larynges showed the nerve proper as plainly as

it can be seen in Figures 1 and 2 in only a moderate number of cases. Habitual search for the nerve will bring it or the fold in which it passes into sight more frequently.

It is not necessary to see the nerve in order to make the injection, as a proper knowledge of its position in the pyriform sinus is sufficient. The overlapping ary-epiglottic fold may easily be pushed aside, so as to expose the site for injection.

As may be gathered from the foregoing, the alcohol injection need only be made superficially. It may be done either indirectly or directly with a long needle. I prefer the indirect method and use a properly curved cannula with a fine needle. This method is easier for the operator and for the patient. The patients experience in most cases a typical pain in the ear, which is quite similar to the pain they have when injected according to the method of Hoffmann. The edema developing in the pyriform sinus after injection gradually subsides. The danger of developing necrosis may be argued as a point against the method, but the writer has not yet observed such a complication.

Cases in which the pyriform sinus is not at all or very little involved by the tubercular process lend themselves best to this procedure.

I use the Alexander syringe with curved cannula and fine point. As the injection is superficial, not more than a 0.5 c.c. of alcohol should be employed.

Because of the possibility of developing a bilateral edema and dangerous dyspnea, it is not advisable to make the injection on both sides simultaneously. As I have brought out in previous papers[4] the edema is a feature common to this method and the one employed by Hoffmann.

The method mentioned here shall not and cannot displace that of Hoffmann, but in cases where the latter and other methods fail, it may be indicated and used. It is a valuable addition and contribution to the arm amentarium in the treatment of dysphagia in tuberculosis of the larynx.

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UROLOGIC & SURGICAL CARE OF NEPHROLITHIASIS*

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NOTHING in the realm of medicine or surgery has appealed to me more, as I grow in years of knowledge, than does the medical aspect of nephrolithiasis with its attendant questions of the physiological function and the chemistry of the formation of urinary output, of the causation and the effect, and of the kindred problems as to treatment in such conditions, with the added problems of the surgical and the physiological mechanics staring one in the face, before operation, at the time of operation, and after operation.

It seems to be simple just to cut down upon a kidney, reach in and get a stone, sew up the patient, and the trick is done! The roentgenogram has proved the diagnosis, and there's the stone!

But he who, in this day and hour, would handle a case in such a manner would be guilty of malpractice, save (and this is the only possible excuse) when the facts are unobtainable or the patient is in extremis.

That "all is not gold that glitters," I would ask you to remember your own experiences and that *no two cases* have ever been exactly alike and that probably 33 per cent of all cases seen are better off without operation and will live longer, day for day, if intelligent medical treatment is given, and as little surgical interference indulged in as is compatible.

In these instances, however, one must array on one side the probable percentage of death within short periods after operation against the known disintegration which is sure to occur during medical treatment, and the eventuality, death, and balance the one probability against the other. This can be done only by a careful and painstaking preliminary, full and complete examination or examinations, extending over a variable period of time and at the hands of those who are accustomed to deal with such cases. In any case, to be hurried is to court disaster.

In most instances it is easy to see the stone in roentgen-ray plate. It is easy to have the radiographer approximate the position of the stone in the kidney area and give its descriptive characteristics, and it may be easy to take out the stone or stones and obtain the professional fee, but what will be the end result in three months, six months, or one year is the important question. To wit:

A patient was operated upon in Italy for stone in the bladder, at the age of ten; and recently at the age of seventeen, appeared with a stone in the left kidney about the size of a marrowfat pea. The radiographer said the stone was in the kidney substance; the tests showed a slight reduction in the function of the left kidney, but only a faint trace of albumin, a few pus cells, and a few red blood cells. He had an antrum containing pus. This was at once given attention by the rhinologist. The patient was then put on medical supportive and antiseptic treatment, and one week later a cystoscopy was done, the kidney "ballooned" with saline solution after the method of Bransford Lewis,[1] and a "cystoscopic succussion" done. In one week there was a colicky pain, and a roentgenogram showed the stone on its trip down the ureter. In the succeeding four weeks he was helped out twice by Crowell's method of ureteral dilatation, and at the end of two more weeks the stone was picked out of his bladder by a Young's cystoscopic rongeur. In eight weeks, approximately, he was delivered of his stone by medical and manipulative means, and three months later his urine was absolutely negative.

What had been this patient's chances, and what are now his chances for a recur-

* Read before the Section of Genito-Urinary Surgery, New York Academy of Medicine, Feb. 20, 1929.

rence without open surgical treatment or with open surgical treatment? In about 20 per cent of all stone cases formerly noted and booked, the stones were passed. Now many more are diagnosed earlier and assisted in passing. In about 25 per cent of single stone cases recorded, there is a recurrence in from one to ten years. The larger majority of these have had the open operation of nephrotomy or pelviotomy. In a group of 28 unoperated, but some manipulated, cases now up to fifteen years, there have been no recurrences, but other pathological defects have been remedied! Does this mean anything?

Chute[2] gives some interesting *surgical* figures in an experience with 50 cases of renal calculi, in the following analysis:

In 7 out of 50, the calculus or calculi had brought about the total destruction of one kidney, and in 6 cases required nephrotomy; 12 other cases showed overwhelming destruction of renal tissue. Thus 19 calculus-bearing kidneys out of 50, nearly 40 per cent, showed seriousness; 9 out of 50 showed bilateral involvement; 14 had symptoms for from five to twenty years before diagnosis was established; 15 had symptoms for one to five years.

He says: "Renal calculi lead to greater destruction of renal tissue than any other surgical lesion, and if allowed to remain they will eventually destroy the kidney that harbors them."

It is with such astounding figures that urologists must deal when *finally* they come in contact with the patient; and most of such patients have not been thoroughly examined elsewhere in their anatomy.

Roughly, my series of 218 cases recorded, extending over a period of fifteen years, shows that the male forms stones in his kidney or kidneys in the ratio of about 4 to 1 as compared with the female. The ages have run from five to seventy-two years, so age is no criterion, but the majority have been from twenty-three to thirty, and from forty-one to fifty-one, with others scattered. This may be because no medical attention has been sought from thirty to forty years, and if *any* consultation has been had it has not been attempted in the robust period of life. In the earlier periods, the patient is brought by the parents; in the later years, fear overcomes reluctance, but from thirty to forty is the "careless period."

Fig. 1. Calculus low down in ureter, and calculus in kidney. To illustrate question of conservatism in manipulation.

A very complete and interesting study of a large group of cases is that presented by Braasch and Foulds from the Mayo Clinic:[3]

In 1917, a Mayo Clinic review showed 504 cases of operation and 10 per cent of recurrence. This review now, of 1041 cases, 1079 operations; 819 traced, 78 to 67 per cent, have all been done more than two years. See table of arrangement:

	Per Cent
Bilateral stones	11.68
Multiple stones	8.96
Single stones	11.77
Branched stones	12.94
Large stones	9.66
Small stones	13.48
Stone in pelvis	11.64
Stone in calyx	12.61
Stone in cortex	10.37
Simple hydronephrosis	3.12
Cases in which stones were passed before operation	16.05

Average period of recurrence, two years; exception chronic stone-forming kidneys.

After second operation for stone, seldom does one have a third stone operation.

Recurrence would seem to be greater after removal of single stone.

Indications for nephrectomy:

1. When kidney is functionless or nearly so.
2. In presence of secondary malignancy.
3. With diffuse advanced infection.
4. In the presence of marked hydronephrosis.
5. Where there has been a previous operation in the kidney with or without fistula.

In operating think of the functional end results and if the person is past the stone forming period.

In pelviolithotomy the renal function remains higher. Operative renal fluoroscopy is of great value.

CONCLUSIONS

1. The percentage of actual recurrence in the kidney following conservative operation is less than 10 per cent.

2. Many of the so-called recurrences are really stones not discovered at the first operation.

3. There is a definite period of stone formation, and the high percentage of recurrences may indicate that the patients were not completely past this period at the time of operation.

4. The percentage of subsequent recurrence in the remaining kidney following nephrectomy is so low (2.75 per cent) as to indicate that an anatomic factor was present in the affected kidney.

5. The percentage of recurrence is greater in cases of single than of multiple stones, and of small than large stones.

6. The percentage of recurrence does not vary greatly with the type of operation for the removal of the stone, but rather with the thoroughness.

7. While pelviolithotomy is the method of choice when possible, the dangers of limited nephrolithotomy have been exaggerated, the percentage of patients having nephrolithotomy who had subsequent hemorrhage being small.

8. Nephrolithotomy is particularly indicated in the presence of cortical degeneration adjacent to the stone.

9. There is a definite group of cases with a history of repeated formation of stone occurring at frequent intervals over a long period.

10. The average interval between primary operation and recurrence of stone is approximately two years.

11. Fluoroscopy has proved to be of great practical value, and no conservative operation for renal lithiasis is complete without it. The percentage for recurrence following operation where the fluoroscope is used, was found to be under 5 per cent.

What causes a calculus? Many suggestions, theories, and attempted proofs have been carried out. It would seem that:

(1) *Bacterial infection* of the kidney, mostly through the blood stream, from teeth, tonsils, ears, sinuses, gall bladders, etc., has a host of defendants. In children, many times, calculi are quite common and are overlooked. It is therefore a wise precaution to take roentgenograms in so-called "pyelitic" children.

A mother heard me lecture some years ago before a mixed audience, in the course of which I mentioned that teeth were a supposed cause for many diseases far distant in the human system. Her daughter, a girl of eight years, was being treated for "pyelitis" and appendicitis by a fairly competent physician who had told her that the child would grow better when her second set of teeth came in, and not to have the rotting first teeth removed. She asked if she might bring her little girl to me, and did so with an explanatory note from the physician. The child had a vaginitis caused by one marble and one safety pin, closed, in her vagina, and when these were removed the vaginitis ceased in ten days. *But* the child had a cystitis also, and roentgenograms showed a small calculus in the bladder and one in the right kidney. Advice was given as to urological manipulation of the conditions as found, and was refused. The physician was duly informed and took the rebuke kindly, but nothing was done! Ten years later the girl was seen one day in a neighboring hospital, quite by accident, and had undergone an appendectomy for a chronic appendix "which had flared up." Fortunately, her mother was near, and on her reminding me of her previous experience with me, I suggested a roentgenogram, which showed a good sized stone in the bladder, probably the old one grown larger, and a long type stone in the ureter, near the bladder.

Apparently the old kidney stone was on its way out! The pus in the urine had been passed over as being from the previous dirty vagina,

Fig. 2. To illustrate question of stasis and formation of calculi from misplaced kidney.

and no catheterization had been done. I believe the appendix was not involved at all, and the surgeon was surprised later at being told what he had left behind. Certainly a urologist would have gone at the case differently.

Roseman has produced stones in the kidneys of dogs, at the Mayo Clinic, by infecting the tooth pulp. Stirling[4] has made a careful study of infection as a cause and believes this is the chief underlying factor. Paul has reported a number of cases of calculi in veterans of the recent war, who suffered from osteomyelitis and must have had blood stream infection.

At least it behooves us to eradicate all foci of possible infection before, during, and a long while after, in calculus cases. This we do not do thoroughly enough, for we lose sight of our patients, and our physicians lose interest after the removal of the stones. *And* we should caution our patients, should they ever become infected in any way, in any part of their body, to check up on their kidney function.

Damon Brown[5] may have arrived at a causative factor in pointing out that the urea-splitting *B. salmonella* is often found

Fig. 3. To illustrate kidney which has stricture and above this intermittent hydronephrosis, with damage to whole organ and probable after-formation of calculus.

as an accompanying organism in the affected kidney.

Cumming[6] has said:

> While the etiological factors concerned in calculus formation are still in the realms of uncertainty, certain practical points, such as its coincidence with infection, are universally recognized; as is the fact that infection adds to the stone bulk, thereby curtailing kidney function and, in the last analysis, destroying the organ.

(2) *Physiological factors*, may be said to be poor diet or diet poorly chosen. We do see cases in which we modify the diet and then are rewarded with recurrences, if we overlooked the first premise and with the analysis at hand try to change the diet and hence the physiology of the urine.

Does it help us to have each calculus analyzed? I think so.

Do certain types of water help toward calculus formation? I believe so. A number of cases come to me from a near-by city for diagnosis, in which small calculi are noted. Strange to say, they are in a certain class, where rich but poorly chosen diet exists, with carelessness of teeth and the ingestion of the city's proverbially hard water. But I have had few recurrent cases from there after warnings as to diet and water of different type.

Only recently a patient who had undergone a roentgen-ray series about six years ago, just before a gastrointestinal series, and was positively told she had no stones in her urinary tract, consulted me, asking that I release a calculus for her which was caught in the cystic portion of the ureter. She had moved to this latter city five years ago, and two years ago was told that she had a left-sided calculus, proved by roentgen ray. The calculus had lain for one year at the ureteral opening, and she had been advised to have an open operation. It was dropped into her bladder through fulguration and enlargement of the orifice, and she passed it in one week. Will she have another calculus? I believe not, for she has now good kidney drainage, and will use other water than formerly.

Many of our city waters are being treated with chemicals. I believe this adds to our growing numbers of renal calculi.

(3) *Faulty metabolism* seems to be a factor, especially in heavy eaters (heavy nitrogenous food) with no exercise, and I believe heavy sodium chloride eaters have this tendency, possibly by its setting up an irritation in certain portions of the kidney and hence giving faulty osmosis.

Patients who are lazy, as fat-forming individuals, or have had old injuries poorly cared for, and others who are confined to bed, suffer as well from this trouble. Why is this so, if not from faulty metabolism and overloaded blood stream, offering a poor medium to the most delicate of filtration plants?

(4) Spitzer and Hilkowitz have propounded and experimented in the theory that *colloidal changes* in combination with crystalloids will cause calculi. They seem at least to have proven one way in which calculi are formed; for normal colloids when precipitated and then altered have been seen to form urinary crystals.

(5) Along the same lines studies and experiments have been tried and recorded by earlier students as to *electrolytic conditions* in the urine, where calculi have been found; and it has been claimed that the calculi were the results of such conditions.

(6) *Mechanical factors*, however, seem to play a larger part, such as pressure from tumor, a gravid uterus, abscesses, or adhesions; from a floating, movable, misplaced, horseshoe or congenital or acquired malformed organ; from ureteral stricture, as so strongly advanced by Hunner of Baltimore; from spasm or paralysis of calyx, due to local or systemic nerve involvement, as put forth by Matas of New Orleans. These and other unmentioned mechanical factors in bladder and ureter, and kidney as well, causing stasis, have their strong advocates of a one-cause theory.

But, personally, I think all of these are factors in greater or less degree, beginning with the faulty metabolism in a patient having a stasis predisposition, on top of which ensues an acute or chronic infection.

How do we know when a stone is present? I recall helping my father in my earlier years of practice, when there was no roentgen-ray and no cystoscope, while he did a needling of a right kidney and, finding no calculus, opened the left kidney and extracted the calculus. How did he know that patient had a calculus? His reasoning from clinical and operative experience in the face of the massive hemorrhage was sufficient in those days, but could not suffice now.

Cumming[6] says: "One of the unfortunate features of stone diagnosis is the lack of symptoms," and yet Lee Brown[7] of Australia has coined a phrase, "reflex renal dyspepsia," by which he describes a syndrome claimed to be pathognomonic

of renal calculus if carefully studied. The more as physicians we personally take clinical histories and not leave it to half-schooled general internes, the more I believe we will be able to formulate a definite precalculus group of symptoms; and if we can but live long enough and keep in touch with certain groups of patients who subsequently again develop renal calculi, and then return to our previous histories I believe this precalculus syndrome may be worked out.

At present, as urological surgeons we are accused of too great a desire to maltreat and overhaul our patients. I believe much of the preliminary roentgenographic and laboratory work should be supervised and made ready by the physician or surgeon, leaving the technical work to the urologist; and I maintain that every case of illness where any pathological urinary or kidney symptoms in deviation from normal physiological action appears should be started on the road to a thorough urological examination, *especially* where blood, pus or albumin are found, and also where gastric symptoms are not clear cut as to a positive stomach or intestinal lesion.

While the pain of certain phases of renal and ureteral calculus is typical, in this day of diagnosis, we still have physicians who are leaning upon the classical symptoms, and a negative reasoning by them oftentimes delays early productive help.

Again we as urologists have to deal with that group of physicians who depend too much on the individualistic laboratory and roentgen ray diagnostician, or even technician, who in his own mind groups the findings and makes his deductions, but not with the facts or reasoning of a urologist. The roentgenologist may miss the stone of uric acid, xanthin, or cystin, or may mistake a calcified abdominal lymph gland. These we must demonstrate by our technique and reason out as to the involvement of the kidney.

Many years ago J. Bayard Clark[8] said in his "Essays on Genito-Urinary Subjects:" "It is not intended to demonstrate the virtues of cystoscopy as a method to replace the longer established means of diagnosing diseases of these organs, but to show what it has added to those means in bringing to light those conditions of the urinary tract so difficult of diagnosis." Had he added, "and of prognosis and after treatment," his statement would have been germane even to this day.

What physician thinks of always having a roentgenogram made where pus is present in the urine? What urologist *neglects* to have one made in such a case? How many surgeons take time enough to have a roentgenographic and a careful urinary examination made in a chronic case of appendicitis where there is plenty of time or in an acute case without temperature and no rise in blood count? And how many of us have had "appendicular stones" to deliver after such hurried operations?

Questions of one or both kidneys being at fault and the remote medical complications are of considerable importance, for just so early as a case is seen and properly diagnosed and treated, so early does kidney function, which we must always seek to maintain, return partially or wholly, to the betterment of the patient.

No set of symptoms, no diagnosis or prognosis is complete, and no treatment (and I say it unreservedly) is ever fully completed in a patient with renal calculus. There are always shadows ahead to be explained and constant changes occurring which we must be wary of. And our patients are ever seeking to be rid of us or of their physician and his admonitions.

We know now that in a growing number of instances a kidney resumes its function tending more toward the normal after removal of a stone, if it has not been damaged too greatly in the operation; and at operation always is the question, when the facts are at hand; is there sufficient kidney parenchyma left to function, or is the percentage too low? Do we choose nephrectomy or not?

"Correct treatment of renal lithiasis, and to a less extent of stone anywhere in the urinary tract, entails a knowledge of function and repair too intimate for complete understanding in view of clinical findings alone," says Cumming.[6]

The urologist has about reached his limit of individual reasoning on this subject and should summon his physiologist to consultation before, during, and in after study of the treatment of lithiasis. It is now our duty to our patients. The "factors of safety" as so called by the late Samuel J. Meltzer in 1907, are to be thoroughly considered before a type of treatment should be outlined. And when outlined, how often must we modify them! It is thus we may use the physiologist, for while some of us try to reason and call upon our dietetic knowledge, or upon the hospital dietitian, we are still in the dark as to the real and correct measures to take along dietetic lines.

Medically, however, we are largely lost, and only as a preliminary to operation or in operable cases can we look with favor in such a manner at the lesion. Judgment herein enters as to what *should* be done, and what *can* be done.

As to these various measures, I will not speak, yet we may learn much from the elders as to how cases were treated before our present refinements of diagnosis and treatment were instituted.

Manipulative treatment is a great step, however, in advance, and with the advent of present-day instruments and their use, much trauma and damage to tissue is averted at the hands of thinking urologists and better results are obtained in a growing percentage of cases. For this we have to thank Lewis, Crowell, Hunner, and many others, in our searching out and relieving the early cases, and then keeping them well by these means, even with minor recurrences.

After whatever means a patient is rendered well, frequent check-ups and treatments of indicated abnormalities are usually needed. We should not let our patients become careless, at least through neglect and forgetfulness on our part.

As for the surgical treatment, so much has been written by urological surgeons that the mechanical part is well known.

The question of preoperative care and preparation is, in my mind, equal in importance to the operation. It matters not how the patient may seek a quick relief, for it is far better to let the patient seek other hands and court death (even though a few pull through) than to stultify one's judgment and approach nearer the danger line.

"General rules" are those followed by the older surgeons, unused to the newer ones of our specialty, or by the youngest so-called general surgeon who essays anything with his knife. These are the ones who forget whether it is wisest to leave the stone in the ureter, following a nephrectomy, to be gone after later by demand of the patient or by contract before the nephrectomy; or to remove the stone in the ureter first before seeking the stone in the kidney by nephrotomy or nephrectomy, a nice question of judgment, at times forgotten. And judgment is required to stay the hand in some types of stone and do the harder operation with foresight, than to do the easier, which may be only palliative, or vice versa.

The general surgeon is usually satisfied when the calculus is removed and the patient has left the hospital, leaving too much to the physician for future guidance and help. The urological surgeon, knowing full well the possible after dangers and how they may be forestalled or met as soon as they occur, seeks to follow through with the case till long after his services may seem to be of use. His after care partakes of prevention of some things which may and many times do occur. His is the problem to search for and to reason out primary causes previously undiagnosed, untouched, or untreated when the case was first seen; and to determine if they are from congenital or acquired physiological causes.

Hence his study of the case at first must

be thorough and painstaking, with all the aids at his command, for it is well nigh impossible to prognose as to a case or logically determine a procedure when the primary facts are unknown. He should examine the patient, and not leave it to untrained or careless hands. From then on in care and judgment there is much more than simple prescription writing to be done if the patient is to be wholly benefited.

How many of us follow our operative cases personally or through the attending physician and have check-ups made to help out this present patient and the one to come, in aiding science? How many physicians help us by doing this check-up or letting us do it?

Shall it be medical treatment alone, or pyelotomy, nephrotomy, partial or complete nephrectomy, or mixed medical and manipulative? There is no hard and fast rule or routine; it is as a general planning a battle, for the local situation is least of all until it be determined how the mechanics of the urinary tract can be improved. The question always is: "If such and such a plan of treatment is instituted, can the remaining kidney parenchyma carry on the work, though still impaired?" Treatment to be correct, must be ideal. Idealism we have not yet reached in medicine; but we may rationally advise the patient, and, if a consultant, we should advise the physician in attendance and if possible take the guidance into our own hands.

If I personally have had any success in this field, it has come from my own examinations, completely made; from my early experience and training, first as a physician then as a surgeon and latterly as a urological student and surgeon.

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DISCUSSION

Dr. O. S. Lowsley: What Dr. Vander Veer said about the recurrence of stones was particularly interesting to me, for we have had some experience with stones and in several instances have learned how to check them from recurring. One particularly interesting case was that of a woman who had been operated on five times by me and by another person two times. I operated on her five times in three years. She had to be operated on because these stones formed in the remaining kidney, which was hydronephrotic. After the third operation it occurred to me that if we could change the chemistry of her urine from alkaline to acid she would not form alkaline stones. This we did, and she promptly went into acidosis; then we experimented, so that we would have a live patient and no stones. We found that by giving her litmus paper and letting her regulate herself and choose her own dose of acid sodium phosphate or sodium benzoate she was able to keep herself acid, and she has not formed any more stones. That is one way of preventing alkaline stones from forming; patients who have cystin stones or uric acid stones have to be alkalinized, but there are borderline cases and mixed stones, so that it is impossible to prevent stones in all cases.

Another question is that of urinary calculi in children. The youngest case we have in our series is that of a boy nine months of age whom I cystoscoped and double catheterized with Dr. Butterfield's excellent baby cystoscope. He had a stone in his left kidney, four stones in his left ureter and a stone in his bladder. We operated upon the bladder, because the frequent painful urination was injuring his health, but we did not like to do any further operation at nine months of age. Within a year after removal of the stone from his bladder, the four ureteral stones dropped into the bladder, and he was operated on again by someone else. Then we waited until he was four and a half years old, and took out two

stones from his left kidney, for the one that was there had been joined by another. We also gave him litmus paper and acid, and a year and a half has elapsed without any evidence of recurrence.

Stones certainly occur more in some localities than others, and more in hot than in temperate climates. When Campbell Begg from New Zealand was here he gave us an idea of why they occur. He was in Mesopotamia, and the men there had to keep a diary every day when they passed their urine, for they had so much skin evaporation that the bladder contained only a little syrupy solution. Practically all the natives had stones in the bladder.

Dr. R. L. Dourmashkin: I wish to discuss the relation of ureteral stricture to etiology and as an important factor in postoperative urological management of stones in the upper urinary tract. I have given the question of ureteral stricture the utmost consideration but as the years go by I come to the conclusion, only clinical to be true, that the focal type strictures are rather infrequent.

However, a congenital stenosis of the ureteral meatus analogous to a condition so commonly found in the male urethra and a congenital narrowing of the juxtavesical portion of the ureter for 2 to 4 cm. is frequently encountered. This anatomical defect was so often observed in my series of cases as to make me believe that it plays an important rôle in producing stasis and nephrolithiasis. It presents a problem which should be seriously considered after the stone is removed by an open operation in order to prevent recurrence. To remove a stone from the kidney leaving this anatomical defect below uncorrected would be equivalent to removing a secondary stone from the bladder leaving a hypertrophied prostate intact.

It is for this reason that the postoperative dilatation of the stenosed area constitutes an important phase in urological management of nephrolithiasis.

The first case is that of a man whom I saw three years ago and who had a large floating stone in the ureter. Cystoscopy showed a pinpoint meatus on both sides and such extensive stenosis of the juxtavesical portion of the left ureter that it was with great difficulty that a no. 4 solid bougie was passed up. It was not of course possible to do a pyelogram in this case but the coiling of the bougie would point to extensive dilatation of the ureter. There was no evidence of calculi on the right side (no pyelogram was done) but it was with difficulty that the catheter passed up through the stenosed area below. The indigo-carmine output was fairly good on the right side but was greatly diminished on the left side.

The stone was removed by open operation and the lower end of the ureter was dilated by catheters and probes while the patient was on the table. He was instructed to report for further dilatation which he failed to do.

I saw him again two or three weeks ago. He complained of attacks of renal pain, this time on the right side and a plain roentgen ray showed a huge stone in the right ureter. The pyelogram showed tremendous dilatation of the entire right ureter with the exception of the juxtavesical portion which was represented by a tiny streak of opaque solution.

The other 2 cases are similar in that they showed stones in the pelvis of the kidney with congenital narrowing of the meatus and the juxtavesical portion of the ureter associated with extensive dilatation of the entire ureter above the stenosed area.

Dr. Vander Veer: I would like to know from Dr. Lowsley what other examinations of his patients showed relative to sinuses, and so on. Were there any recurrent stones?

Dr. Lowsley: The boy of nine months showed nothing. The young woman was a school teacher who had never had any serious illness. We did not transilluminate her sinuses, but none of the examinations we made showed any defects. Her teeth were in good condition. We did not make a vaginal examination for she was averse to it.

SIGNIFICANCE OF LYMPH GLANDS ON THE ANTERIOR SURFACE OF THE PECTORALIS MAJOR MUSCLE*

ITS BEARING ON OPERATIVE PROCEDURE & END RESULTS IN BREAST CANCER

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FURTHER examination of large slides which enable one to study under the microscope not only the tumor but the entire breast and its surroundings have impressed the writer with the frequency and importance of finding that the first area for involved lymph glands in breast cancer is on the anterior surface of the pectoralis major muscles and not behind the muscle in the auxillary space.

This fact must certainly be of considerable importance in determining the best operative procedure and it also must be of considerable importance in the end result.

That the first station for lymph glands is in front of the muscle does not seem to be appreciated. Deaver and McFarland in their work which is justly accepted as a classic do not mention these glands and refer to the important gland groups as axillary, retropectoral, and supraclavicular as the principal systems, and the upper brachial and axillary nodes of the opposite side, and the supraclavicular (of the opposite side?), as the adjacent systems.

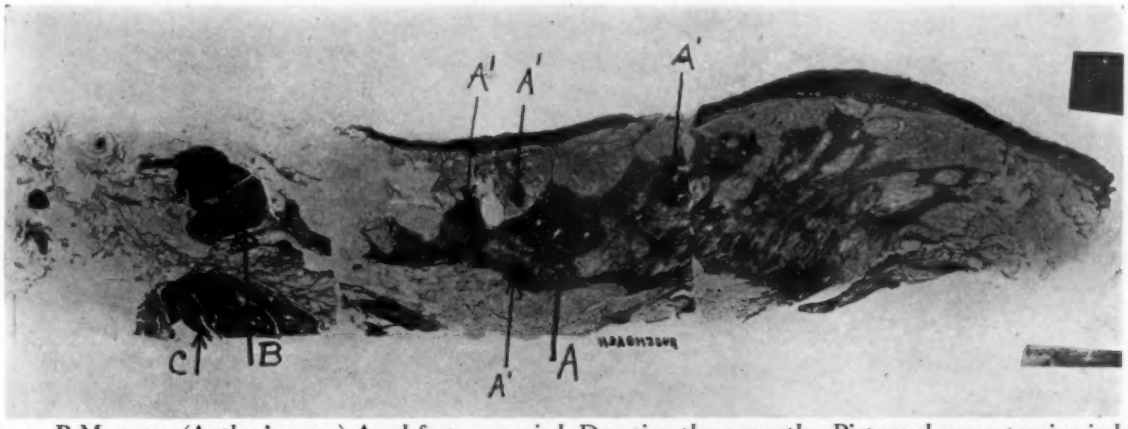

FIG. 1. B.M. 1191. (Author's case.) Aged forty, married. Duration three months. Picture shows extension in left breast following removal of right breast for primary tumor seven months before. A, primary tumor with nearby extensions. B, large lymph gland in front of pectoralis major, C. (½ actual size.)

Even Pierre Delbet and Mendoro in their remarkably complete and scientific monograph ("Les Cancers du Sein") begin to picture lymph glands only when they have cut the pectoralis major, retracted the cut ends, and exposed the axillary space lying behind the muscles (pp. 109–113). Recent journal articles are equally reticent on this point.

The result is that as one sees breast operations at various clinics it is quite evident that the anterior surface and outer edge of the muscle which is equally affected in this connection are considered as safe areas and are frequently exposed and handled with apparent impunity. Indeed they may be thoroughly disturbed with fingers, gauze wipes, or instruments. When the muscle is cut and the axilla exposed then a very careful technique is employed so that

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the axillary contents may be removed en bloc, taking great care if possible not either to see or feel a lymph gland.

every single strategic point no matter how trivial it may seem.

As proof of the contention that the

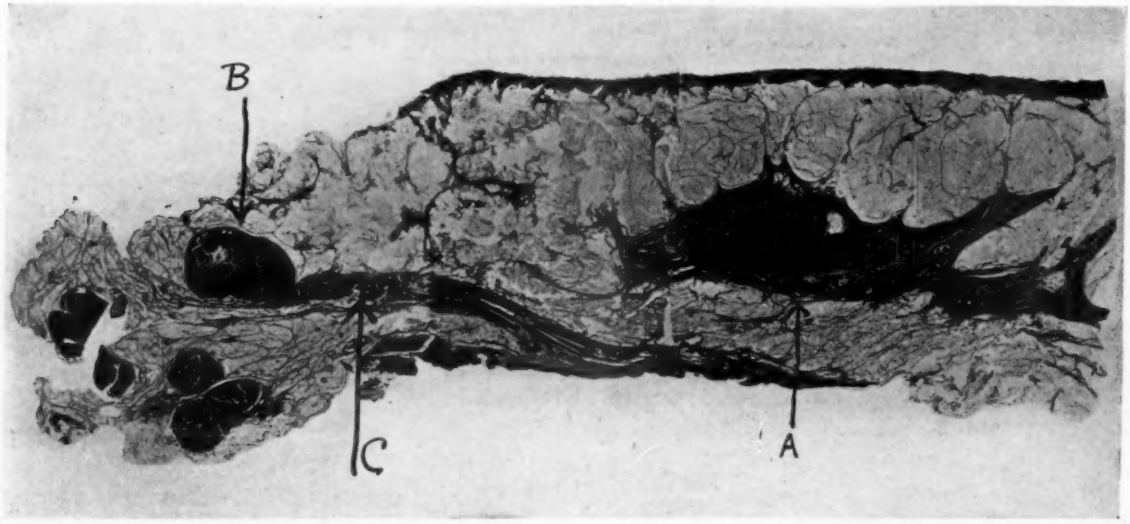

FIG. 2. B.M. 686. P. H., N. Y., 69871. (Courtesy Dr. A. Purdy Stout, N. Y.) Aged forty, 5 children, youngest aged ten. Duration "over one year." Four months after operation metastasis above clavicle. Grade "high malignancy." A, primary tumor in upper outer quadrant. B, large lymph gland involved at anterior surface and edge of pectoralis major, C. (⅝ actual size.)

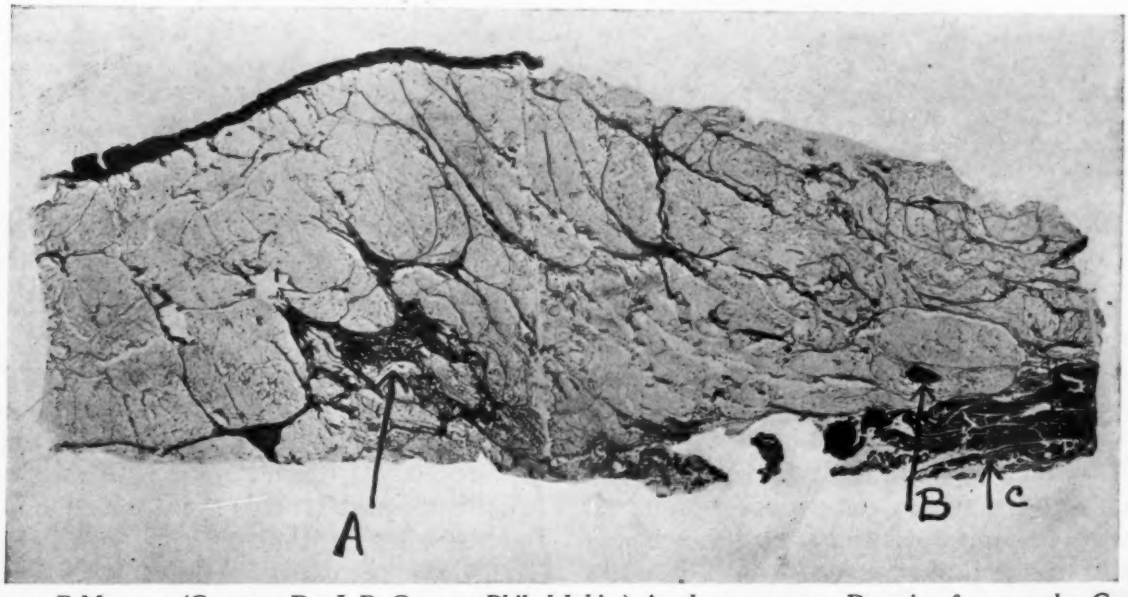

FIG. 3. B.M. 1112. (Courtesy Dr. J. B. Carnett, Philadelphia.) Aged seventy-one. Duration four months. Grade "low malignancy." Well eight months after operation. A, primary tumor in upper outer quadrant. B, lymph gland in front of pectoralis major, C. (⅝ actual size.)

It seems certain that the ignoring of the first gland station, no matter how carefully the second station is treated, must be one reason for some of the distressingly frequent recurrences. When dealing with breast cancer it is certainly necessary to take the fullest possible advantage of

first lymph gland station is on the anterior surface of the pectoralis major, five characteristic slides are shown. Figure 1 is a slide 11 inches long by actual measurement and shows the entire "theater of war" from the ensiform cartilage through the entire breast on across the anterior surface

and edge of the pectoralis major muscle and thence on to auxillary fat. The summit of the skin curve indicates the position of the nipple through the latter is not actually shown in this section. Beginning at the right of the section, non-malignant breast tissue of the lower inner quadrant is seen. Further to the left in what represents the upper outer quadrant, is the primary tumor A, roughly ¾ inch in diameter. Near by at A^1 are other secondary nodules. At B is a large carcinomatous lymph gland in front of and near the axillary edge of the pectoral muscle (C).

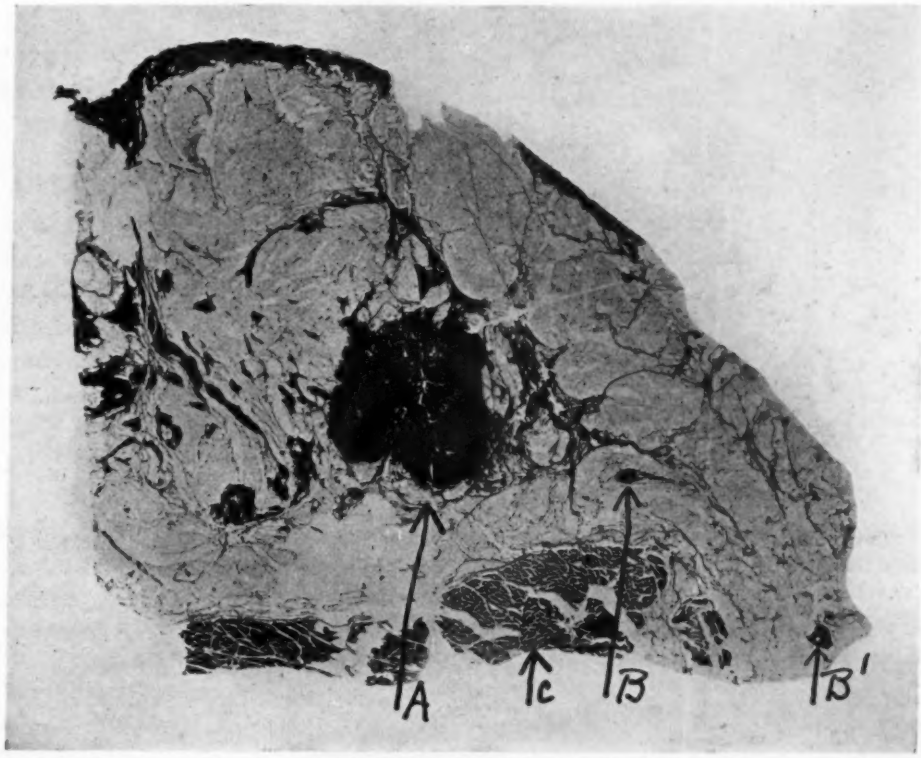

Fig. 4. B.M. 851. (Courtesy Dr. Harvey F. Smith, Harrisburg.) Aged sixty-four, married, never pregnant. Duration one year. Died (January 2, 1928) one month after operation, of heart failure due to over-exertion at holidays. A, primary tumor in upper outer quadrant near nipple. B, lymph glands in front of and at edge of pectoralis major, C. (Actual size.)

Figure 2 is somewhat similar to Figure 1. At A is the primary nodule. At B is a large carcinomatous gland in contact with the anterior surface and outer edge of the muscle.

Figure 3 shows a feathery type of primary tumor at A. At B there is a small lymph gland in front of the muscle (C).

Figure 4 shows a large dense primary tumor at A. At B there is a small lymph gland in front of, and at B^1 a small gland at the edge of, the muscle (C).

Figure 5 shows a large dense primary tumor at A. At B there is a small lymph gland in front of and near the edge of the muscle (C).

In Figure 6 is shown a primary tumor A and two lymph glands at B in front of the pectoralis major muscle (C, C′).

It would seem that these six illustrations should be quite sufficient to establish this point and impress the fact that in every operation for breast cancer the anterior surface and edge of the pectoralis major muscle should be considered as important a "noli me tangere" area as the axilla and that this area should never be exposed or handled or traversed by fingers, instruments, or gauze.

It is fortunate that scrupulous care in this regard does not demand a new incision or an unestablished operative plan. The principles of skin incision as established by Mr. Handley quite cover this require-

ment. It is more important, however, to adopt as universally as possible Mr. Handley's principle of beginning removal of fat, fascia, axillary contents, muscles, and breast from the edge or even posterior surface of the latissimus dorsi muscle and completing the removal of all these structures in one mass by carrying the dissection inwards and downwards from behind the muscles and dissecting closely to the structures that must be left behind in the chest wall. In this way and in this way only can the dangerous area on the anterior surface and edge of the pectoralis major muscle be as carefully respected as the axillary contents or indeed the primary growth itself.

In conclusion it may once more be stressed that in breast cancer advantage must be taken of every possible point. If the anterior surface and edge of the pectoralis major muscle are avoided as carefully as they should be, it seems certain that a considerable number of recurrences will be eliminated.

(A deep personal obligation is hereby expressed to Maj. George R. Callender, Curator Army Medical Museum, for his kindness in providing the photographs.)

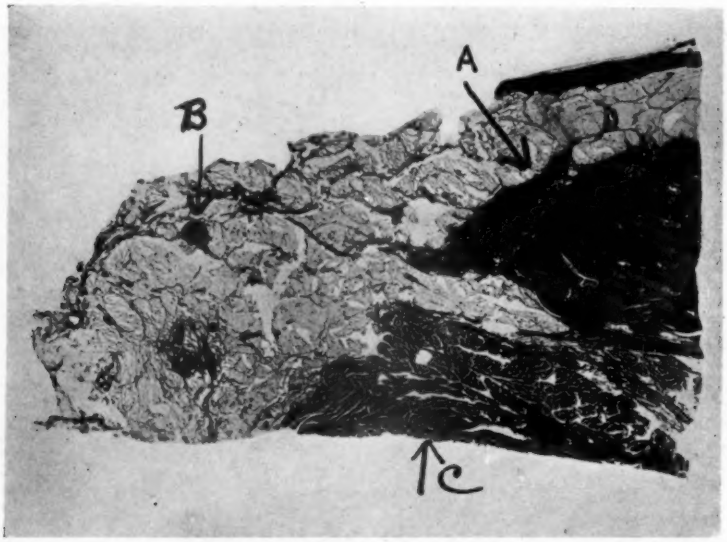

Fig. 5. B.M. 1111. (Courtesy Dr. H. B. Gibby, Wilkes-Barre.) Aged forty, single. Duration five months. Grade of malignancy "high." Tumor in lower outer quadrant. A, primary tumor. B, lymph gland above and in front of edge of pectoralis major, C. (Actual size.)

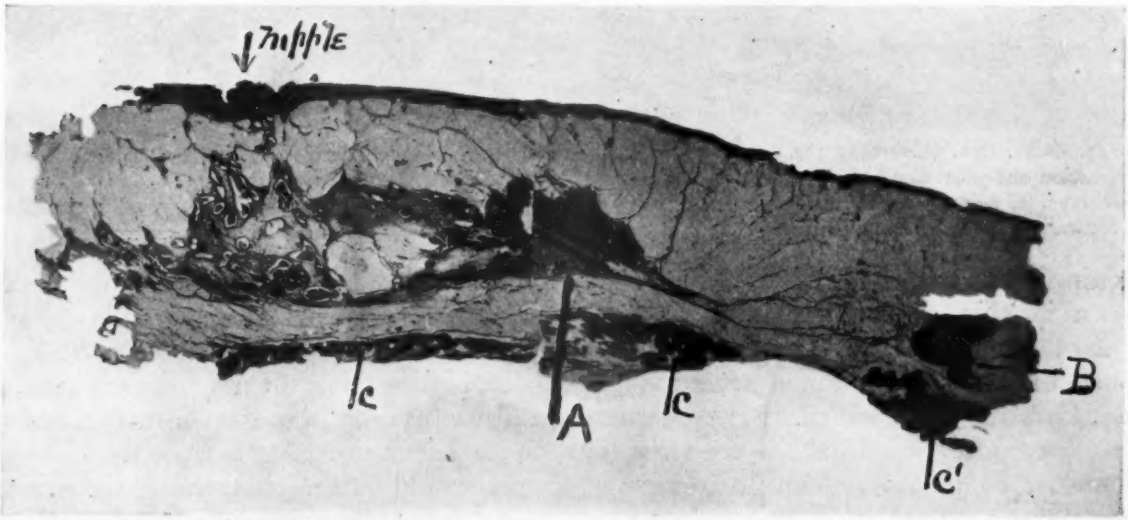

Fig. 6. Mrs. R. B. M. 1191. (Courtesy of Dr. J. N. White, Scranton.) Aged fifty-five. Grade, medium malignancy. Section shows practically entire breast, including nipple. Breast area shows marked cystic dilitation in ducts. A, primary tumor. B, two lymph glands in front of pectoralis major muscle, C and C'. (⅝ actual size.)

SPLENIC ANEMIA*

WILLIAM F. HOWARD, M.D., F.A.C.S.

POCATELLO, IDAHO

THE case here reported is one of splenomegaly with anemia and leucopenia accompanied by severe gastric hemorrhages and followed by ascites with some liver changes. There is a varied nomenclature for these conditions and some inconsistent ideas expressed by the students of its several stages or its more or less inclusive symptoms and findings, but this case is so complete in detail and so positive a clinical finding that I desire to report it as I have observed it, regardless of what name may be applied.

The numerous reports written since 1920 include a wide variety of conditions and symptoms with an attempt by some writers to mention all cases reported since Banti's article was first published in 1882. And a remarkable thing to be observed is that all writers who attempt to limit the scope of their papers to the subject of splenic enlargement with anemia and leucopenia, differ most in language and arrangement of the subject discussed, a peculiar and decided tribute to the first student of the disease to which his name has been given.

There is nothing new about this disease except that the question of its entity can always be considered. The single cases have been studied, some for many years and one for as much as twenty-five years after splenectomy. In a study of end-results of 35 cases Hanrahan gives 38 per cent living without operation and 50 per cent living after operation, including early postoperative deaths. This half of those operated upon died during observation. Much more could be said concerning this percentage of end-results and it is certainly more favorable to surgery than the figures indicate. Some of the operated cases must be considered cured and none of the patients not operated upon are cured, and these last must continue to add to the mortality of the non-operated group. Reports the past ten years give a mortality of 12 per cent.

The knowledge of this disease is so definite without being complete that I shall use this opportunity to review some reports and to report 1 case under treatment.

The anaemia splenica of Osler is synonymous with splenic form of pseudoleucemia or of Hodgkin's disease, primary splenomegaly, endothelial hyperplasia of the spleen, splenomegalic cirrhosis of the liver, Banti's disease, etc. Some of the synonyms are no longer used because continued study has resulted in general use of the name popularized by Osler for the condition modified more or less by each individual writer, splenic anemia. And Osler's definition seems most widely adopted: "A disease, probably an intoxication of unknown nature, characterized by great chronicity, primary progressive enlargement of the spleen, which can not be correlated with any known cause, anemia of a secondary type with leucopenia, a marked tendency to hemorrhage particularly from the stomach, and in many cases a terminal stage with cirrhosis of the liver, ascites, and jaundice (Banti's disease)." Osler in 1902 reported 15 cases of his own and seems to have believed the disease to be a distinct entity. Hanrahan (1925) concludes that splenic anemia is not an entity but a syndrome that may be brought about by various causes. Krumbhaar remarks that since negative methods are the only methods now available of diagnosing Banti's disease, many cases of splenomegaly due to syphilis, cirrhosis, portal obstructions and other causes undoubtedly are included in the study of splenic anemia and that it is

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difficult to distinguish them when successful removal of the spleen in the latter group results in improvement. Moynihan also says that diagnosis is usually made by microscopic examination of the spleen and inspection of the liver, while Chaney shows how little value is to be placed on microscopic examination of the spleen.

Rolleston discussing this group of symptoms says that the term Banti's disease is often used as synonymous with splenic anemia even by those who fully recognize that Banti's disease is a terminal stage of splenic anemia, a statement which could be decidedly questioned, because generally accepted definitions and descriptions include the early stage of splenomegaly with anemia. Warthin (quoted by Bell) suggests that many if not all cases of splenic anemia are caused by obstructions of the splenic and portal circulation due to thrombophlebitis. Krumbhaar in an exhaustive study of the blood holds that all anemias are produced by a lack of balance of the blood-making and blood-destroying apparatus whether due to a lack of production or an excess of destruction. This condition evidently exists but we do not know why or the cause for its beginning. Some recent reports assume that the terminal stage as mentioned by Banti and Osler must be reached before a diagnosis of Banti's disease is made, and a larger number of reports seem to hold that the term Banti's disease should be applied only to the terminal stage of the disease, so accurately described by Banti and later by Osler. This is not according to Banti nor Osler, both of whom described this disease from first to terminal stages so clearly that when we include diseases of known causation or exclude cases not yet in the terminal stage we are not then discussing the same disease according to their descriptions and definitions. If any case resembling splenic anemia more or less completely has a known causation such as malaria, syphilis, tuberculosis, or other definite determinable cause, that case cannot be classed as Banti's disease according to definition but must be called a malarial spleen, syphilitic spleen, etc., and the symptoms are then considered only as manifestations of the causative disease. Very naturally this leads to the increasing practice of extending Osler's definition. For while there are cases of splenic anemia with unknown causation, there are thought to be cases of malaria and syphilis not to be clearly demonstrated as such. Warthin's observation that many cases of splenic anemia are caused by thrombophlebitis of the splenic and portal circulation may be found to apply to all cases. If so then this disease would lose its entity and become the splenic and portal obstruction of syphilis, malaria, tuberculosis etc., simply marked by the syndrome that we now call splenic anemia. And we would have to conclude that the cases of unknown causation were due to some of the causes not demonstrated. The name splenic anemia was first used by Griesinger and Gretsel in 1866, by Banti (1883 and 1894) and popularized in this country in 1900 and 1902 by Osler, and as used by them did not include other forms of splenomegaly nor other forms of anemia; they did include primary splenic enlargement with anemia and leucopenia and it was considered to be progressive to the terminal stage of cirrhosis with ascites. We must so use the term splenic anaemia as defined until we are able to make a better classification.

The increasing inclusiveness of the name must be an element in the rapid increase of the number of cases reported. In 1883 Banti reported 3 cases, 1891 Bruhl reviewed all cases, 14 in number, and in 1902 Osler brought the subject up to date with 15 of his own cases. In the past fifteen years reports of splenic anemia, extended to include other conditions, have greatly multiplied, leaving the splenic anemia as defined as rare a condition as previously. Sweetzer was able to collect only 42 cases in 1922, and of these, 12 cases were of known etiology leaving but 30 cases of Banti's disease. Here Sweetzer

excluded, as having a known causation, more than half of the cases reported up to that time. Balfour (1916) had seen 31 cases; in 1910 Banti reported 36 cases, Fisher in 1922 summarized 71 cases, including cases of known causation, splenectomized with a mortality of 12 per cent. Hanrahan summarized 31 cases at Johns Hopkins Hospital, and numerous cases are reported by other writers singly or in groups, having or not having a known causation.

This disease has been considered comparatively rare among children. It is a rare disease at any age but the cases among children as reported according to Osler's definition are at least 8, and number as many more according to more liberal classifications, which makes 8 children out of 30 cases (strict limitation of term) reported or 17 out of 71 by a liberal inclusion. There have been reported following the Banti and Osler description the following cases among children:

Bell reports the case of a girl aged six operated upon November 1924, with recovery.

Kingston reports the case of a girl aged five and one-half years, operated upon, with recovery.

Leech reports a case in a boy aged nine years who was operated upon and died the same day.

A case mentioned by Rosenthal was operated on at three years of age, recovering.

Byfield reports the case of a boy six years of age who was operated upon and recovered.

West reports the case of a boy nine years of age, who was operated upon and recovered.

Haggard reports the case of a boy of eight who was operated upon and recovered.

Balfour reports 1 case, a child, who was operated upon and cured.

The case I am here reporting, that of a child of seven years, makes at least 9 cases among children classed as fully meeting the accepted definition out of 30 cases reported by Sweetzer to which this case has been added. But it is clear that a greater number than 31 has been reported. Banti reported 36 and Osler 15, making 51, and a considerable number must be added to this. Even then 9 cases among children out of a possible 100 cases reported is not a small percentage for children considering the marked chronicity of the disease. Even if we consider the broadest conception of 300 cases manifesting the important and most evident symptoms of the disease as variously reported, the percentage of children does not differ much. So we must conclude from reported cases of the past twenty years that splenic anemia is not comparatively rare among children.

As a disease is further studied and increasing numbers of cases reported there is an increasing number of physicians liable to recognize that disease. The first cases reported were among adults but now a sufficient number among children are known to have been observed and successfully operated upon that we need not longer consider tender years as a negative factor in diagnosis. Of these 8 children there were 2 girls and 4 boys and 2 of whom the sex is not mentioned in the writings consulted. Seven were reported well at the time of report. This is a 12.5 per cent mortality, the usual mortality reported in the past ten years.

The case here reported has so far as I have been able to determine an unknown causation. There is no history, family nor individual, of any disease that could be considered as a causative factor. The Wassermann and tuberculosis tests are negative. The child has lived in a locality in which malaria is unknown and she has not malaria.

The pathology may be summarized as primary splenomegaly consisting of hyperplasia and fibrosis of the spleen with no uniform special microscopic findings, anemia of a secondary type and relative leucopenia and cirrhosis of the liver leading

to ascites. Since my patient is under observation and has not been operated upon I can report splenic gross pathology from physical examination and roentgen-ray films only. This spleen extends across the midline of the abdomen and below the crest of the ilium. It is rather smooth, not at all nodular and the notch is plainly to be felt in its relative position. The abdomen is greatly distended with ascitic fluid so that the liver margin cannot be palpated, but percussion and roentgen-ray examination show the liver to be hypertrophied to a moderate degree.

The superficial lymph glands are not enlarged and there is no evidence of adenitis. The anemia is of secondary type, regularly shaped cells with achromia and not marked by poikylocytosis. There is nothing to distinguish the anemia from an ordinary secondary anemia. This child has raised blood at various times in the past year, the source of which is undetermined. At no previous time has there been sufficient amount to cause enough concern in the family to consult a doctor. Then a sudden acute hemorrhage occurred in which large amounts of blood, clots, and red and dark blood were vomited, and the stools were black with blood several days following. This continued for five days, the child occasionally vomiting dark blood, sometimes clots, and the stools showed black several days longer.

Pigmentation is said to vary and it is suggested by West that the pigmentation is due to arsenic which has so often been administered for the anemia. Pigmentation cannot be referred to the adrenals because no pathology of the adrenal glands has been reported. In this case there is only slight pigmentation.

Ascites is said to be a symptom of the terminal stage and has been observed to be due to portal obstruction. It is yet to be decided that the portal circulation is always or usually involved. In my case there was a caput Medusae and a marked ascites, and only slight edema of the lower extremities. The ascites was so great that it seemed necessary to perform paracentesis but this was delayed from time to time and along with other improvements in the patient's condition the fluid fully disappeared. Subsequently abdominal examination gives much more decided findings.

Jaundice according to reports is commonly observed either with or without cirrhosis. The liver is commonly of ordinary type or it may extend a few inches below the costal margin. In this case there is the marked pallor of anemia with an icteroid tinge, not a marked jaundice. The liver was at first observed about 2 inches below the ribs and remains the same. The liver dullness is now easily defined and readily palpated since the disappearance of the abdominal fluid. Roentgen-rays at first observation and after the disappearance of the ascites confirm these physical findings.

The literature consulted stresses the utmost care in diagnosing splenic anemia. Due consideration must be given many possible sources of error and after all consideration there may remain some degree of uncertainty. The earlier the diagnosis is made the more tentative it must be. When anemia and leucopenia have developed there is greater reason for assurance, and gastric hemorrhage and ascitis with cirrhosis make the cases reasonably sure to be Banti's disease. In this paper it is merely mentioned without discussion that we must exclude, in arriving at a diagnosis, various infections, pernicious anemia, Hodgkin's disease, neoplasms, the obstruction due to cirrhosis, heart disease, sclerosis, probably Gaucher's disease, some other obscure disease of infancy or childhood, ulcer of the stomach, and possibly tumor of the left kidney.

Prognosis: This disease is one of marked chronicity until the final stage is reached, the diagnosis practically certain, and the case ready to terminate. The non-operated cases are progressive and do not get well. The mortality after operation has steadily decreased. In 1910 Banti reported 36 cases of splenectomy as follows:

First stage: 3 cures in 4 splenectomies, three, five, and fifteen years after operation

Second stage: 13 cures in 22 cases operated on, well seven to fourteen years after operation.

Third stage: 4 cases living out of 10 operations.

In 1915 Giffin reviewed 27 cases splenectomized with 3 operative deaths, 8 dead in ten years, 2 of which were from hemorrhages more than one year after operation. Three other patients had hemorrhages but were living at the time of his report. Also in 1920 he reports 71 cases with a hospital mortality of 12.6 per cent, with 27 living five years after and 1 eleven years after operation. Sweetzer gives the mortality of the operated cases up to 1908 as 72 per cent, up to 1913 as 56 per cent and up to 1921 as 26 per cent and the cases reported since 1920 show a mortality of 12.5 per cent which gives a chance of 7 in 8 apparent cures.

Medical treatment is entirely symptomatic and has not cured any cases reported, and it has not been reported to have resulted in any marked arrest of the progress of the disease. Roentgen-ray therapy has been reported to result in marked improvement but no cure. The splenomegaly and its attending symptoms have been decidedly reduced but at its best the roentgen ray treatment has only served to prepare its patients better for the only cure, operative treatment, so far reported. It must be then the natural conclusion that until some better treatment is developed we must depend on splenectomy.

Phylis W., female, aged six, brought to Pocatello, Idaho, by Dr. M. C. McKinnon of Aberdeen, Idaho, because of gastric hemorrhage. Father living and healthy. Mother living and healthy. Mother has had five children, all living and, except Phylis, well and healthy. Mother has had no miscarriages nor premature births. Three sisters and one brother all well. No family history of any heriditary nor chronic disease.

Phylis was born in Idaho and was never 50 miles from her home. Her only ailments have been superficial abscess of the left chest at three weeks of age, treated and promptly healed, leaving a contracted scar over the spleen. Measles 1924, no complications nor sequelae; scarletina May 1926, good recovery, not kept in bed with either. Parents say she has always been healthy though pale since infancy. Grandfather says he urged that she be sent to a doctor a year or so ago for examination or treatment. On September 24, 1926, following a car ride on a cold and blustery day, in which she seemed to have caught cold, she vomited, and passed tarry stools. September 25, vomited blood and clots but did not stop school. On October 4 sent home from school because of sickness and weakness. Brought 40 miles in automobile to Pocatello and walked into my office, a pale anxious child with staggering gait. At the hospital examination was made, and symptomatic treatment was instituted.

Six-year old girl, ordinary size and development, rigid muscles, fixed shoulders, no pain, marked pallor and asthenia. Eyes bright and sclera pale and clear. Ears normal, tonsils seem normal, no adenitis. Heart area about normal in size but to left and upwards 1 inch, nearly horizontal. Systolic hemic murmur, no clearly normal sounds. Pulse 160, lungs, shallow respiration 40, no râles, no dullness; abdomen greatly distended by fluid and tumor mass, slightly tender, mass in left abdomen plainly palpable from left costal margin to 2 inches above pubes and extending to the middle with notch about middle, dullness over tumor, not nodular and rather solid. Mother had noticed large abdomen a long time. Tympanitic over vault of abdomen and dull or flat on sides when lying on back. Tympany changed with change of position, ballotment. There was increasing prominence of superior epigastric vessels, caput Medusae, liver margin about 2 inches below ribs; roentgen-ray films show spleen, liver, heart about the same as physical examination, diaphragm elevated and kidneys normal in size and position, skin pale, slightly pigmentated but no bronzing, very slight or no edema of legs. The patient was put to bed and treated for shock and hemorrhage. Urine report negative. Blood report showing red cells 1,740,000, leucocytes 5,400, hemoglobin 25 per cent, lymphocytes 36 per cent, transitional 2 per cent, polymorphonuclears 62 per cent. Widal test negative. Wassermann tests negative, negative to tuberculosis tests October 6, direct transfusion 350 c.c. with

mother as donor, marked temporary benefit. The next day vomiting blood reduced the red count to 1,600,000 and 20 per cent hemoglobin, with achromia, poikilocytosis and the child seemed approaching the end. On October 9 roentgen-ray treatment over spleen and liver was begun and has been since continued and the child has so greatly improved as to seem in ordinary health. She left the hospital October 31 with the idea of returning later for splenectomy. Her blood count at the time was: R.B.C. 2,230,000, W.B.C. 5,200, and the ascites was disappearing and spleen reduced in size to the level of the umbilicus. She was taking food, digesting it and felt like sitting up. On November 20 returned for roentgen-ray treatment. Blood examination showed R.B.C. 3,400,000 W.B.C. 4600, hemoglobin 38 per cent. Color index 0.50, small lymphocytes 15 per cent, large 6 per cent, transitional 1 per cent, and polymorphonuclears 78 per cent, weight 38 lb., weak but feeling better and gaining. Spleen further reduced and fluid disappearing.

December 8, erythrocytes 4,000,000, leucocytes 4500, hemoglobin 50 per cent, color index 0.70, some achromia and poikilocytosis, weight 44 lb., color slightly pale, spleen reduced to 3 inches below costal margin. March 1, 1927; looks and feels well, color good, cheeks pink, R.B.C. 4,210,000, W.B.C. 6400, spleen still about 3 inches below costal margin, weight 49 lb. March 27 feels well, attending school, weight 49 lb., well nourished, seems well. Spleen not palpable at costal margin except downward at kidney area, liver margin at edge of ribs, no ascites.

November 5, 1927, W.B.C. 7800, R.B.C. 4,800,000 hemoglobin 77 per cent, spleen reduced to costal margin except a rounded tip to be palpated over left kidney, weight 54 lb., looks well and feels well.

March 8, 1928 has had no illness for more than a year. September 22, 1928, weight 57 lb., R.B.C. 4,800,000, W.B.C. 6700, good color, no apparent abdominal enlargement, spleen scarcely palpable at left, looks and feels well. Has attended school and not been limited in any of the activities of a farmer girl of her age.

One cannot determine from the direct history that this attack was not due to acute splenic and portal obstruction at the time of exposure to blustery weather and so far as we can say this may be the cause of the attack. But there is the further history of continued pallor since infancy, some raising of blood and the enlarged abdomen with the obtrusion of the left costal margin that favors chronicity. She has had a gradually enlarging spleen with some degree of anemia since infancy. I cannot otherwise conclude than that this is a case of splenic anemia as described by Banti and Osler.

Treatment in this case has been symptomatic during the severe symptoms, later tinctura ferri chloridi in small doses, sodium cacodylate every third day subcutaneously and the continued use of roentgen-ray treatment for four months at biweekly intervals and then occasionally for a year longer. The treatment was given in order to prepare for splenectomy and the patient is now so greatly improved that the parents refuse treatment at this time. She is still under observation. All parties concerned consider that sudden severe symptoms may again endanger her life, but her present condition is so satisfactory that she may delay the operation with the hope of escaping it. At any rate with the patient now in apparent good health and growing as well as other average children of her age, I am willing to withold recommendation for any other line of treatment.

HYSTERECTOMY WITH PRESERVATION OF OVARIES*

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THE preservation of the ovaries is admittedly so important that mere technical difficulties should not deter the surgeon from attempting it whenever possible and indicated. The technique described below is not difficult and renders certain the preservation of the ovaries. The writer has applied the procedure in only 2 cases: some points of technique may be changed according to circumstances; the fundamentals, however, are plain and easily understood.

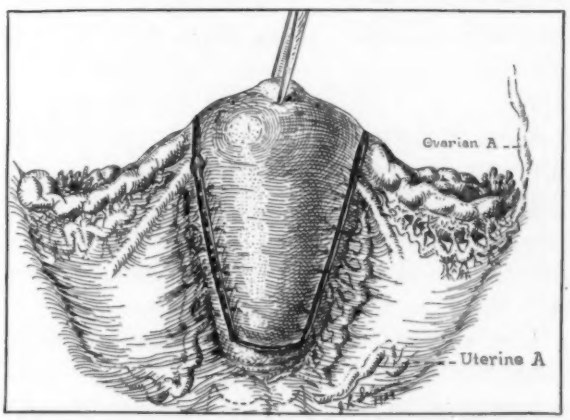

FIG. 1. Line of incision of peritoneal covering of uterus, with preservation of uterine arteries.

The basic idea is that, whether a complete or partial hysterectomy is done, in many cases the ovaries may be preserved. The preservation of the ovaries may be possible only if their blood supply is good. The ovary is supplied with blood by the ovarian and uterine arteries, which anastomose in the ovary. The preservation of the uterine artery is therefore essential. The uterine artery does not enter directly into the body of the uterus (Fig. 1). Only small branches given up by the main artery enter the womb. The main artery runs between the two leaves of the broad ligaments, is tortuous in its course and more or less close to the uterus, but never in intimate close contact. Given these anatomical conditions it is possible to dissect the uterus away from the broad ligaments leaving the uterine arteries intact and consequently not affecting the normal circulation of the ovaries.

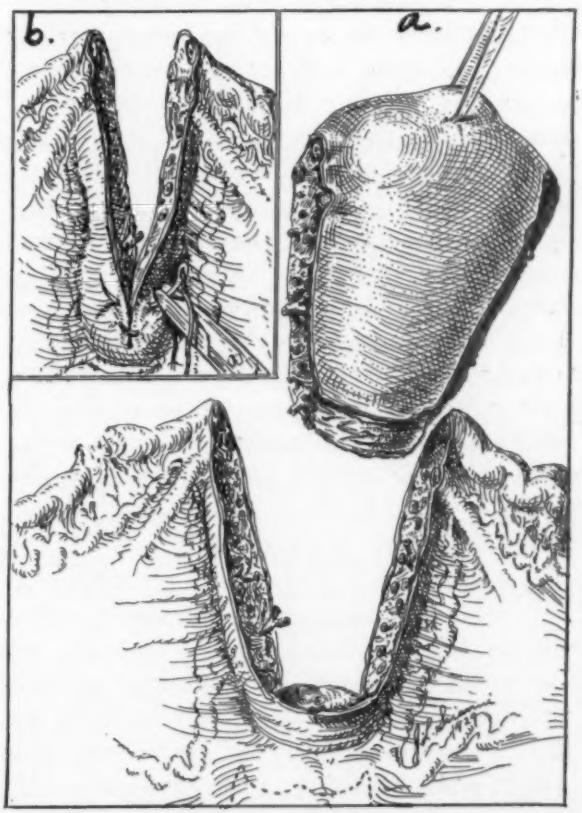

FIG. 2A. Uterus has been dissected away from broad ligaments, leaving uterine arteries intact. B. Approximation of broad ligaments.

The technique adopted by the writer in 2 cases was as follows:

The fundus of the uterus was grasped by vulsellum and pulled upward very firmly (Fig. 1). The peritoneal lining at the neck of the uterus was incised with a scalpel and then gently separated upward and on both sides, care being taken to

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keep in close contact with the uterine body. The neck was then amputated by gentle strokes, so as to incise only the uterus. When the neck had been incised completely we grasped it with a vulsellum and pulled it gently outward so as to expose the posterior layer of the peritoneum which was then also gently separated from the uterus and incised. The body of the uterus was now completely separated from the neck, only the broad ligaments holding it in the abdomen. Practically no bleeding occurs up to this time. The peritoneal covering of the uterus is then incised along the attachment of the broad ligaments, starting on either side (Fig. 2a). By blunt dissection the body of the uterus is separated from the broad ligaments in front, laterally and backward. The uterus is now connected by the tubes denuded of peritoneum, and thin layers of posterior peritoneum. The tubes are severed from the uterus and the posterior layer of the peritoneum is incised on both sides of the uterus, leaving the uterus completely free. Very little bleeding takes place, in fact in one case practically no bleeding at all occurred during the whole procedure, because the blunt dissection tears away the small vessels, which do not bleed when torn. The operation is finished by clamping any bleeding vessels, and suturing together the two broad ligaments, when possible, or peritonizing the cut edges if approximation is difficult. (Fig. 2b.)

CONCLUSIONS

A technique for hysterectomy, with preservation of the ovaries, which is not more difficult than an ordinary hysterectomy, is described. The procedure requires only a great deal of gentleness on the part of the surgeon and his assistants.

The uterine arteries are pushed away from the uterus and remain intact. The circulation of the ovaries is completely preserved. Practically no bleeding and no shock result from the operation.

THE RECTAL EXAMINATION AND THE CONCEALED SECOND STAGE OF LABOR*

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THE purpose of this paper is to point out a potentially serious danger in the rectal examination, namely, the danger of overlooking a concealed second stage of labor.

The following question immediately suggests itself: If a serious danger is resident in the rectal examination, why counsel its use when a vaginal examination permits greater accuracy of diagnosis? This question can be satisfactorily answered only after a thorough consideration of the relative aseptic merits of the rectal and vaginal examinations.

As far as I know, it has never been proved that, with any approximation to care in technique, the rectal examination can introduce bacteria into the vagina. From this standpoint it may be considered as harmless as no examination. If pathogenic bacteria are already in the vagina at the beginning of labor, due to an infected cervix or due to their introduction by intercourse, digital examination, septic douche nozzles, douches, etc., within a few days prior to labor, the rectal examination cannot be expected to protect the patient from the likelihood of a postpartum infection. In such a contingency, it has been objected that by a rectal examination one will smear the pathogenic flora over the inside of the cervix. The mechanism of normal labor is open to the same objection because the advance and recession of the presenting part and the bridge of membranes must tend to spread the vaginal flora. It is likely that in any labor, as soon as the cervix dilates and the cervical plug of mucus is dislodged, the vagina and uterus become one cavity and act as a Petri plate as regards extension of bacteria, modified of course by the flow of discharges and the bactericidal character of the discharge. The work of J. Morris Slemons[1] on placental bacteremia tends to substantiate this likelihood; also the statistics of increased likelihood of infection following the performance of cesarean section late in labor and after the rupture of the membranes even when no vaginal examinations have been made. No bacteriologic proof has been offered, to my knowledge, of the spreading of bacteria by the rectal examination. However, statistics obtain that would tend to suggest that no examinations in labor may be less productive of postpartum rise of temperature and infection than the rectal examination. Even if this were certain, the fact remains that in the course of teaching and practice, only a comparatively few cases can be allowed to go without a pelvic examination because of the demands of diagnosis, of following the progress of labor, and of handling the problem of alleviation of pain in labor.

Ralph A. Reis,[2] in an analysis of 271 cases examined by rectum only and 106 cases where no examinations were made, recorded the following findings:

All cases: afebrile cases, no examination 56 per cent, rectal 46 per cent. Spontaneous cases: afebrile, no examination 64 per cent, rectal 54 per cent. Pelvic infections: all cases, no examination 4.7 per cent, rectal 6.3 per cent. Spontaneous: no examination 4.9 per cent, rectal 6.6 per cent.

To my mind the figures of Reis point more clearly to the importance of prenatal care than to a clear deduction of the advantages of no examination over the rectal examination.

Concerning the vaginal flora of preg-

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nant women and the potential danger of the vaginal examination we have much evidence at hand.

In 1894, Krönig[3] concluded from a study of 100 pregnant women that "the vaginal secretion of pregnant women who have not been examined, no matter whether normal, pathologic or highly pathologic, never contains organisms which grow aerobically upon the ordinary media at the body temperature except yeast and gonococci and therefore never contains septic bacteria." "The vagina of every pregnant woman who has not been examined is therefore aseptic."

In the same year, Krönig[4] demonstrated that the vaginal secretion possessed a marked bactericidal action upon pathogenic organisms when introduced into the vagina and stated that "we may consider the vagina of a pregnant woman as aseptic if we are sure that two or three days have elapsed since she was touched."

In 1898 J. Whitridge Williams[5] published a report on the bacteria on the vagina and their practical significance based upon the bacteriologic examination of the vaginal secretion of 92 pregnant women. His conclusions were:

1. We agree with Krönig that the vaginal secretion of pregnant women does not contain the usual pyogenic cocci, having found the Staphylococcus epidermis albus only twice in 92 cases, but never the Streptococcus pyogenes or the Staphylococcus aureus or albus.

2. The discrepancy in the results of the various investigators is due to the technic by which the secretion is obtained.

3. As the vagina does not contain pyogenic cocci, auto-infection with them is impossible; and when they are found in the puerperal uterus, they have been introduced from without.

4. The gonococcus is occasionally found in the vaginal secretion and during the puerperium may extend from the cervix into the uterus and tubes.

5. It is possible but not yet demonstrated, in very rare instances, that the vagina may contain bacteria which may give rise to sapremia and putrefactive endometritis by auto-infection.

6. Death from pureperal infection is always due to infection from without and is usually due to neglect of aseptic precautions on the part of the physician or nurse.

7. Pureperal infection is to be avoided by limiting vaginal examinations as much as possible and cultivating external palpation. When vaginal examinations are to be made, the external genitalia should be carefully cleansed and disinfected and the hands rendered as aseptic as for a laparotomy. Vaginal douches are not necessary and are probably harmful.

To section 6 of Dr. Williams' deductions I would like to add, intercourse within a few days of labor, manual vaginal examinations by the patient, and unsterile douche nozzles and douches. I have felt justified in attributing many cases of sepsis to each and every one of these causes, where no examinations or operative procedures of any kind had obtained during labor and the preparation of the patient and the delivery technic and postpartum care were apparently as near perfect as possible. Postpartum sepsis following spontaneous deliveries during which no examinations or rectal examinations only were used I believe to be attributable to infractions of prenatal care instructions or to failure to give any prenatal care instructions.

In 1902 Hjalmar Bergholm[6] published a most searching bacteriologic study of the vaginal secretion in pregnancy. His conclusions coincide with those of Krönig and Williams as regards the sterile character of the vaginal secretions in pregnant women. He states that "neither the Staphylococcus pyogenes albus or aureus nor Streptococcus pyogenes nor Bacillus coli, is to be found in the vaginal secretion of the pregnant woman. The flora of the vulvar secretions is materially different from that of the vaginal secretions."

All these investigations permit one to feel with a large degree of assurance that, barring the presence of gonorrheal infection, meticulous prenatal care should

bring the pregnant woman to labor with a sterile vagina. The consideration from the beginning of labor is to keep it sterile. Many of us believe that the rectal examination will do this, barring lapses in aspetic technic in the preparation of the patient for labor and in the conduct of labor and the puerperium.

In this regard, what do we know about the safety and the potential danger of the vaginal examination conducted under strict aseptic technic?

We know of course that the better the technic the less chance there is of introducing infection into the vagina. Striking proof of the benefit of refinements in technic is brought out in the 1913 reports from the Sloane Hospital for Women, New York City.

In these reports Dr. E. C. Lyon, Jr., showed that the routine use of the sterile rubber glove in vaginal manipulations markedly reduced the incidence of sepsis. In 16,000 cases before rubber gloves were routinely used, the incidence of sepsis was 1.13 per cent. In the last 12,000 cases in which the sterile rubber gloves were routinely used the incidence was 0.61 per cent.

The most striking bacteriologic demonstration of the potential danger of the vaginal examination can be found in a comparison of the researches of J. Withridge Williams in 1893[7] and 1898.[5] In his earlier work Williams found pyogenic cocci in the vagina in 53 per cent of his cases, including 20 per cent streptococci. In his later work, he found pyogenic organisms in only 2 per cent of the cases and not a single streptococcus. Williams' explanation of these differing results is, "the only explanation which suggests itself is that in the first series of cases bacteria, which were upon the labia minora and the margins of the hymen, were carried into the vagina by the introduction of the speculum and were then demonstrated in the cultures, while in the present series that possibility was avoided." The speculum referred to was a sterilized cylindrical glass speculum about two centimeters in diameter. In other words, it was about the size of examining fingers.

The potential danger of the vaginal examination suggested itself to Slemons[1] in his work on placental bacteremia.

The potential danger of the vaginal examination is apparent in the comparative statistics of cesarean section without and with previous vaginal examinations.

As regards the actual statistical data concerning the relative safety of the aseptic vaginal and the rectal examination, one cannot find many large series in literature.

Pfleiderer[8] cites Jegge (Basel) as having compared 500 cases examined vaginally with 500 cass examined rectally. Those examined vaginally developed temperature in 11 per cent of cases as against 6 per cent with the rectal examination.

Guggisberg[9] presents compelling figures from the Poliklinik at Bern.

1901 to 1911	
Cases examined vaginally	4642
Temperature reached 37.5	17½ per cent
Genital infection	11.2 per cent
Deaths from sepsis	0.12 per cent
1912 to 1921	
Cases examined rectally	3010
Temperature reached 37.5	11 per cent
Genital infection	5.5 per cent
Deaths from sepsis	0

I have been unable to find in literature any comparative statistics equal to these statistics in point of number of cases compared in which the vaginal examination appeared to be more safe than the rectal examination.

Reis[2] compared results in 609 cases examined by vagina
271 cases examined by rectum.
106 cases delivering without examinations.

Pelvic Infections, All Cases

	Per Cent
Rectally examined	6.3
Vaginally examined	5.9
No examinations	4.7
Spontaneous	
Rectally examined	6.6
Vaginally examined	5.3
No examinations	4.9

Reis also tabulated his cases according as they were febrile or afebrile. Any patients showng more than one-half (0.5) degree rise of temperature at any time during the first seven days postpartum were considered, for the purposes of this investigation, as being febrile.

AFEBRILE CASES

All Cases

	Per Cent
Vaginal only	47
Rectal only	45
No examination	56

Spontaneous Cases

Vaginal only	57
Rectal only	54
No examination	64

Reis made this investigation in 1924 in an attempt to determine what differences, if any, in morbidity rate and infection rate occurred following the two types of examination in a well-conducted maternity. He concludes:

It would seem, from a study of the figures presented above, that the percentage of absolutely afebrile cases is definitely increased when neither rectal nor vaginal examinations are made and conversely that the percentage of pelvic infections is definitely decreased. There appears, however, to be practically no difference between the group examined vaginally and the group examined rectally. This holds true for the percentage of afebrile cases as well as for the percentage of pelvic infections. If then, as most workers agree, the rectal examination is only 90½ per cent efficient for diagnosis, and if it is especially inadequate in abnormal and pathologic cases, it would seem that at least one vaginal examination is desirable early in every case of labor, particularly since there is no increased danger of infection from such an examination if carefully and properly done. That the number of vaginal examinations should be limited as much as possible is self-evident from a study of the figures presented.

"The rectal examination is, however, of value in observing the progress of labor and should supplement the initial vaginal examination. The rapidity and ease with which the rectal examination can be made recommend it strongly, but it does not seem that the rectal examination should replace the vaginal examination, especially in a well-conducted maternity where vaginal examinations can be made under aseptic conditions.

In the early part of his article Reis says:

In this series, the majority of cases were examined vaginally because the routine care of service cases in the Michael Reese Maternity required one careful vaginal examination immediately upon admission and preparation of the patient. The only exceptions to this routine are cases of appreciable vaginal bleeding or patients whose histories, measurements, or abdominal examination might indicate the possibility of a cesarean section.

After viewing from all angles the results of bacteriologic research, and all comparative statistics extant at the time concerning the relative safety of the vaginal and rectal examinations, I was led, in 1913, to change from the use of the routine vaginal to the routine rectal examination. Since that time, each year's experience, in all types of situations and conditions, has added to my conviction that the rectal examination is potentially the safer examination and that the vaginal examination under the most meticulous aseptic technic, should be used only when the rectal findings leave one in doubt. It is my belief that the universal teaching and use of the rectal examination, considering all types of conditions surrounding the obstetric patient, would reduce the incidence of postpartum sepsis.

The following advantages are resident in the rectal examination:

1. With any approximation to care, the rectal examination cannot introduce bacteria into the vagina.

2. The sterilizable rubber glove, combined with ordinary cleanliness and gentleness, make it possible for even the most inexperienced student to conduct the examination without danger to the patient.

3. Without any increase in danger to the patient, the rectal examination permits of repeated examinations in all types of surroundings irrespective of any limitations offered by the examiner's training and perfection in aseptic technic.

4. It permits of repeated examinations with a great saving of time to the attendants and the examiner and with a great saving of inconvenience to the patient because of the fact that the rectal examination does not require the elaborate preparation for its performance necessitated by the aseptic vaginal examination.

5. Its teaching and use seems to emphasize the potential danger of the vaginal examination and stimulates all attendants to use as careful methods of preparation for performance of the vaginal examination as should be called for in the preparation for any obstetric operation.

6. In over 95 per cent of cases that will terminate spontaneously, the rectal examination, in conjunction with the abdominal examination, will meet all the requirements of teaching and practice by giving all the data necessary for diagnosis, for following the progress of labor and for scientifically handling the problem of the alleviation of pain in labor.

7. In any case in which only rectal examinations have been used, if the necessity for interference arises we can institute said interference with the assurance that the rectal examinations have not introduced pathogenic bacteria into the vagina. Especially is this of great importance in cases complicated by antepartum hemorrhage and in those cases in which from the history, physical, and measurements we suspect that a cesarean section may be indicated with or without a test of labor.

8. The present-day knowledge among educated people, of the danger of infection in labor makes the use of the rectal examination a source of reassurance to the patient and her family. When only rectal examinations have been used, if a postpartum rise of temperature takes place the physician and the patient's family can have an increased feeling of security engendered by the fact that no infection could have been introduced into the vagina by the rectal examination. To me this feeling of greater security following a delivery without vaginal manipulations is of great value because it acts as a source of confidence in the ultimate outcome of the case and decreases the strain of practice.

There are certain basic elements in the technic of the rectal examination that are of great importance in rendering it without danger. First and foremost, the gloves used should be boiled so that no infection can be taken from case to ease. The hands should be washed and dried, the glove drawn on the examining hand and plenty of sterile lubricating jelly or vaseline applied to the examining finger. One must be careful not to frustrate the nursing technic of keeping the external genitalia clean. The examiner must be careful to keep away from the vulva. It is easy for the thumb of the examining hand to come in contact with the vulva or even the vagina if one is not aiming to avoid such a slip.

Although it is conceivable that one could be so careless and rough as to injure the anus and rectum, I have never seen such an injury. Even to the uninstructed, gentleness suggests itself, or is suggested by the patient.

It is unquestionably true that it is more difficult for the student to master the rectal examination than for him to master the vaginal examination in respect to accuracy of findings. But this difficulty is largely offset by the increased number of examinations he is allowed to make and therefore by his increased experience. My experience has taught me that the best way to initiate teaching in the rectal examination is to initiate it in the gynecologic and obstetric out-patient department, where on all gynecologic cases and on all pregnant cases in the early months the rectovaginal examination may be made and the student can check up his rectal findings by his findings with the vaginal finger. In this way he soon learns to delineate the cervix and appreciate its varying consistency and he soon learns the feel of an external os that will admit the

finger. He also learns to appreciate any slight difficulties offered by the recto-vaginal septum and the rectal valves. By the same token, rectal examinations alone, of patients in the last six weeks of pregnancy, especially in multiparae, are most instructive because in many of these cases the presenting part is easily felt and obliteration of the cervical canal and even dilatation has in many instances gone far enough to be distinctly manifest. If a student has had this practice he will soon master the rectal examination in labor. The potential accuracy of the rectal examination was impressed upon me lately when, in going over four hundred consecutive labors, I found that no vaginal examination had had to be used in spontaneous deliveries and in operative deliveries the preliminary vaginal check had substantiated the rectal findings.

All errors associated with a diagnosis by rectum of complete dilatation of the cervix have been in my experience without serious consequence. We have all likely experienced the inconvenience of being called by an intern and found the patient prepared and draped for immediate delivery and, when nothing happened, discovered upon rectal examination that he had not reached up far enough to find the os and had mistaken a well-obliterated cervical canal with a slight dilatation of the external os for complete dilatation. This mistake, though inconvenient, could cause no harm. We have all no doubt experienced the mistake of diagnosing complete dilatation in the presence of a tissue paper cervix with a pinpoint os. I have seen this mistake made with a vaginal examination and the mistake recognized only after visual examination with a speculum. Again, this is a mistake of little consequence because with no advance, after an arbitrary two or three hour period, the vaginal examination will have checked up our error.

The only serious error that I have seen resident in the rectal examination is associated with the diagnosis of an undilated cervix. It is a serious error in the interpretation of rectal findings that may lead to disaster from incorrect management. This error consists in overlooking what I have come to designate as a concealed second stage of labor. Call this condition what you will, the rectal findings should lead one to suspect it and corroboration should be sought in the vaginal examination.

The rectal findings consist in a peculiarly soft cervix that hangs down from the presenting part like the open end of a bag; the cervical canal is obliterated but the external os does not appear to be completely dilated; and one is surprised at the case with which one can pull the cervix from side to side in the attempt to palpate the directing features of the presenting part. During a pain the cervix may disappear, only to appear again between pains. This is the cervix that may be found upon vaginal examination to be potentially completely dilated and offering no obstruction to the descent of the presenting part.

These findings obtain most frequently in conditions interfering with complete flexion of the head or favoring extension of the head. I have encountered it most frequently in occiput posterior positions especially of the frontocotyloid variety.

It is a relatively infrequent condition, however, occurring in my observation in about 1 per cent of cases. However, as this makes it approximately six times more common than measurements necessitating cesarean section, at least in the State of Minnesota and its environs, and as incorrect handling may make its nonrecognition as disastrous as the nonrecognition of indications for cesarean section, I consider it relatively important.

The plausible explanations for these findings that suggest themselves are: that the peculiar position of the head by pressure, reflexly interferes with the normal retraction of the cervix; that actual pinching between the head and the pelvis interferes with retraction; and that both

of these conditions are associated with the phenomenon that the head extends after previous flexion and jumps away from the dilated os much as a man walking on his head makes the steps by flexing and then suddenly extending his head.

The likely and usual series of events following the nonrecognition of this so-called concealed second stage of labor are: the obstetrician carries the woman along in the belief that she is in the first stage of labor and, after hours or days of labor, is puzzled by the fact that there is no advance of the presenting part and no change in the cervix. Finally when signs on the part of mother or child demand interference, the real nature of the condition becomes manifest when one goes in to decide upon the best maneuver for the successful consummation of delivery. Unfortunately by this time, especially if the membranes have ruptured early, version, a possible first choice, may be contraindicated and high forceps is the remaining alternative if the head is high. The end-result, of course, will depend largely upon the dexterity of the obstetrician, but, at best, the chances are not promising because of the condition of the child and mother. Had this condition been suspected and recognized early, it is likely that no contraindication would have existed to interfere with a deliberate choice of the best maneuver for delivery and the delivery would have been executed with the child in good condition and with the mother not exhausted and not in a debilitated condition making her a more easy prey to any low-grade infection that might be present.

The following two cases are of interest because in each case the condition obtained in two successive labors and the difference between correct and incorrect management is clear.

Case I. Mrs. E., aged twenty-five years, grav. i. History, physical and prenatal care history normal. Measurements: Intersp. 27½, intercristal 29½, exter. cong. 20, R. ext. obliq. 22½, L. ext. obliq. 22½. int. cong. not reached. Normal. Transverse outlet 8½. O.L.A. position. Patient at term. Labor began at 11 P.M., February 22, 1923. Desultory pains for practically two days. Never less than four minutes apart. Patient sustained by necessary sleep and rest provided by narcotics and soporifices. Light nourishment. At 8 P.M., February 25, although the cervix by rectum was distinctly felt to be undilated the patient was taken to the delivery room. No change had taken place in the cervix for hours and there was no progress in descent. By vagina the cervix was found to be potentially completely dilated. The membranes were ruptured artificially and the case allowed to proceed. No advance in two and three-quarters hours. Exhaustion of mother. High forceps applied, Position O.L.A. Baby delivered dead in thirty-five minutes. Bleeding from nose and left ear. Likely a fractured base. Total labor seventy-two hours, forty-five minutes.

Mistakes: Did not become suspicious of a concealed second stage of labor by rectal examination and thus unnecessarily increased the length of labor. Chose forceps rather than version with the head high, and little or no moulding. Final postpartum examination showed cervix in excellent condition. A partial check that the child was not drawn through an undilated cervix.

Same patient. July, 1924. Labor at term. O.L.A. Labor began 5:30 P.M., July 2. At 9 A.M., July 3, the cervix was soft and not completely dilated as felt by rectum. A concealed second stage of labor was considered. At 11 A.M., after no change in the rectal findings as to cervix and descent of head, the patient was taken to the delivery room for a vaginal examination. Vaginal examination showed cervix potentially completely dilated. Head high. Membranes ruptured artificially, immediate version and breech extraction. Latter performed with ease and a 9 pound 9⅝ ounce live baby delivered. Total labor eighteen hours.

This labor I believe was handled correctly. It would not have been had I not suspected, by the feel of the cervix by rectum, a concealed second stage of labor, and immediately checked up by findings by a vaginal examination. On the charts I explained the lack of descent of the head to be due possibly to attitude. Version broke up this faulty attitude.

Case II. Mrs. A., aged twenty-six, grav. i. O.L.A. position. At term. History, physical

and antepartum care history normal, except for anemia in the latter part of pregnancy that did not respond to treatment. Measurements: Intersp. 26, intercr. 28, ext. cong. 20, L. ext. obliq. 22, R. ext. obliq. 22½. Transverse outlet 8½; int. cong. not reached. Normal. Labor began at 2 P.M., July 22, 1925. Hb. 62 per cent. 2:30] A.M. July 23, cervix soft, cervical canal obliterated, 3 fingers' dilatation. 10 A.M., July 23, cervix soft, cervical canal obliterated, 3 fingers' dilatation. 11 A.M., cervix soft, cervical canal obliterated, 3 fingers' dilatation. At 5:18 P.M., exhaustion of mother, no change in cervix and descent of head. A vaginal examination was made and the cervix was found to be potentially fully dilated. Membranes intact. O.L.A. position. Membranes ruptured artificially and because of the high position of the head a version and breech extraction was done. Normal 8 pound 6⅞ ounce child delivered. Total labor twenty-seven hours, thirty minutes.

I should have become suspicious of the concealed second stage earlier and checked up with the vaginal examination. She ran a mild postpartum sepsis and left the hospital on the thirty-first day postpartum. This twelve hours of what I believed, after delivery, to have been an unnecessary extension of labor may have been a factor in her postpartum sepsis by lowering her resistance, especially in the presence of an anemia.

Same patient, June, 1928. At term. O.D.A. position. Again anemia in the latter part of pregnancy that did not respond to treatment. Hb. 60 per cent. Labor began at 5 P.M. 6:15 P.M., rectal examination. Complete obliteration of cervical canal. Two fingers' dilatation. 10:30 P.M., cervix very soft. Three fingers' dilatation. Concealed second stage suspected. 1:10 A.M., no advance of head and noc hange in cervix. Vaginal examination revealed the fact that the cervix was potentially completely dilated. Membranes ruptured artificially. O.D.A. position. Version chosen because of high position of head. Easy version and breech extraction. Live child weighing 8 pounds 6⅜ ounces. Total labor eight hours, thirty minutes. Normal puerperium except for anemia.

In this case I feel certain that the early recognition of a possible concealed second stage of labor and a vaginal check saved this woman many hours of unnecessary labor with the concomitant danger of reduced resistance therefrom.

To one experienced in rectal palpation, the danger of error in diagnosing a concealed second stage of labor by rectum when it does not exist, is only the danger of an occasional vaginal examination under the most rigid conditions of asepsis. The dangers likely to attend the nonrecognition of the condition by rectum have been stated.

In the last analysis, conditions of operative dexterity being equal, the ultimate results will depend upon one's ability to recognize a potentially fully dilated cervix by vaginal examination, because, if one attempts an extraction by forceps or a version and breech extraction through a cervix not completely dilated, he courts one of the commonest present-day causes of fetal morbidity and mortality and maternal morbidity.

SUMMARY

1. A summation of the results of bacteriologic research and labor statistics bearing upon postpartum sepsis point to the conclusion that, whenever a pelvic examination is necessary in labor for purposes of diagnosis, of following the course of labor and of scientifically handling the problem of the alleviation of pain in labor, it is expedient to use the rectal examination first and use the aseptic vaginal examination only in those cases in which the rectal findings leave one in doubt.

2. The greatest potential danger resident in the rectal examination is overlooking what has been called a concealed second stage of labor. In this condition the cervix, though potentially completely dilated, is easily palpated by rectum and may give the impression to one not keeping the entity in mind, of a cervix not nearly completely dilated, and one may allow the patient to continue on in labor without making a vaginal check, believing that she is in the first stage of labor when she is really in the second stage of labor. Unless one keeps this possibility in mind, one may not find out his mistake until untoward signs on the part of mother

and child demand interference and when depending upon the time of rupture of the membranes a choice of the maneuver best suited for a successful delivery may not be made, as for instance, version with a high head, and when the conditions of mother and child are not so conducive to ultimate success as they would have been had the concealed second stage of labor been suspected and found on aseptic vaginal examination hours before.

3. The rectal findings that should lead one to suspect a concealed second stage of labor are: a peculiarly soft cervix that hangs down from the presenting part like the open end of a bag; the cervical canal is obliterated but the external os does not appear to be completely dilated; one is surprised at the ease with which one can pull the cervix from side to side in the attempt to palpate the directing features of the presenting part; during a pain the cervix may disappear only to appear again between pains. Where these findings obtain, make an aseptic vaginal examination and proceed according to the indications of the findings.

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CASE REPORTS

CARCINOMA OF HERNIAL SAC*

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BROOKLYN, N. Y.

U. R. aged sixty-seven, admitted to the Jewish Hospital, February 19, 1928, with the complaint of "swelling" in the left groin.

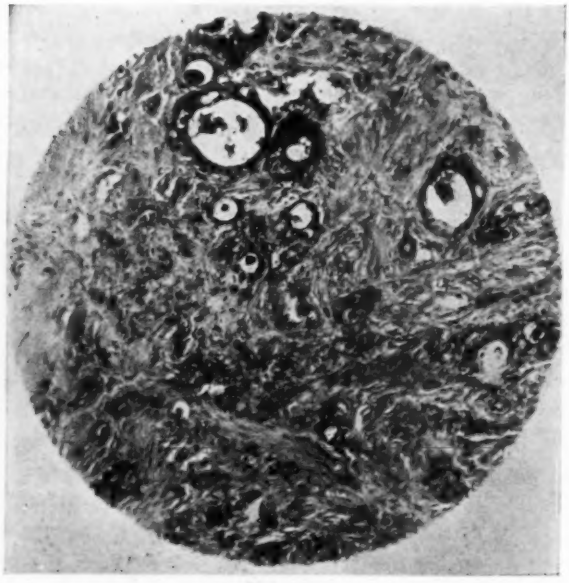

FIG. 1.

Past history was negative except for a left inguinal hernia of forty-eight years duration. The patient always wore a truss and was never inconvenienced.

Present illness began three months previously with a small, hard, painless swelling in the left groin, which increased in size somewhat. One month later, a second hard nodule appeared near the first and within the preceding month, both swellings have fused and grown slightly larger. There was slight difficulty in starting the stream. Nyct-uria 2 times; no diurnal frequency. No loss of weight. Appetite good. No gastrointestinal complaints. No venereal history.

Examination: Patient is well preserved for age and appears to be in good health. The positive findings were as follows: Genitalia: A hard, irregular, nodular growth is present in the left groin, about the size of a large walnut. It is not tender. With finger in the left inguinal ring, a definite impulse is felt on slight cough and with increased coughing a mass is visible and easily reducible. This is apparently not associated with the hard mass above noted. Rectal Examination: Moderately enlarged prostate. No suspicious areas. No Blumer's shelf. Abdomen: Slightly tympanitic. Otherwise negative. Urine: S.T. Albumin. Sugar negative. Occ. gran. and hyaline casts. Occ. W.B.C. B.P. 152/100–108/68.

Impression: (1) Tumor of spermatic cord; (2) inguinal hernia; (3) adenoma of prostate.

Operation: February 20, 1928, under spinal anesthesia. Incision parallel to and 2 cm. above Poupart's ligament 8 cm. long. Findings: After careful dissection, the hard mass was somewhat freed from the surrounding tissues. It was found to be closely adherent to the spermatic cord, rock hard, irregular and nodular. Further dissection revealed the masses to be localized in a large hernial sac, the walls of which were thick, tough and fibrous. Deep palpation of the sac gave a feeling of shot-like masses throughout. The testis was atrophied and a moderate amount of hydrocele fluid was present in the tunica. The vas was isolated from the cord and found to be normal. The sac was incised and the examining finger found the sac lining covered entirely with shot-like nodules. Exploration through the internal ring found the same condition existing throughout the peritoneal cavity. Procedure: Herniotomy and removal of adherent spermatic cord and testis. Usual hernial repair.

Laboratory Report: Macroscopical: The specimen consists of testis and adjacent tissue; one portion shows a thickened mass, section of which shows nodular thickening and the inner lining of remaining portion is studded with

* Presented before the Brooklyn Urological Society, March 12, 1929.

grayish white, firm irregular nodules. Microscopical: Solid mass consists of adenocarcinoma.

The diagnosis was therefore carcinoma of the peritoneum with extension to the hernial sac. A gastrointestinal series subsequently was negative. Frequent follow-up examinations were made and revealed a gradually increasing Blumer's shelf. The patient became increasingly weaker and died in a few months.

This case is reported (1) as a unique form of carcinomatous extension in a hernical sac; and (2) because of the error in diagnosis it may prove of value in further cases of similar nature.

AN UNUSUAL RECURRENT MAMMARY TUMOR

WITH PATHOLOGICAL OPINIONS

Leo Dretzka, M.D., F.A.C.S.

DETROIT, MICH.

TUMORS of the breast containing muscle tissue are exceedingly rare. A careful review of the literature reveals essentially no definite reports of authentic cases. Ewing refers to leiomyoma of the nipple and skin and mentions the publications of Virchow and Sokolow in 1873 and Niklas in 1889.

The breast contains very little smooth muscle tissue outside of the blood-vessel walls, but if the histology of the duct and its acini is recalled, it will be remembered that there is a single layer of longitudinally arranged unstriated muscle fiber between the epithelial basement membrane of both ducts and acini and the underlying layer of delicate connective tissue consisting of bipolar and stellate cells. Beneath this connective-tissue layer is the elastica which surrounds all ducts and some acini. In the wall of the duct outside of the elastica is a thicker layer of unstriated muscle which disappears when the acini are reached. The nipple also contains a considerable number of unstriped muscle fibers. It is possible to have a few strands of striated muscle in all epithelial tumors of the breast, but this is part of the stroma rather than of the neoplasm.

As a rule, the common benign tumors of any organ consist of the kind of tissue which normally predominates in that organ. For example, we have gliomas of the brain, leiomyomas of the uterus,

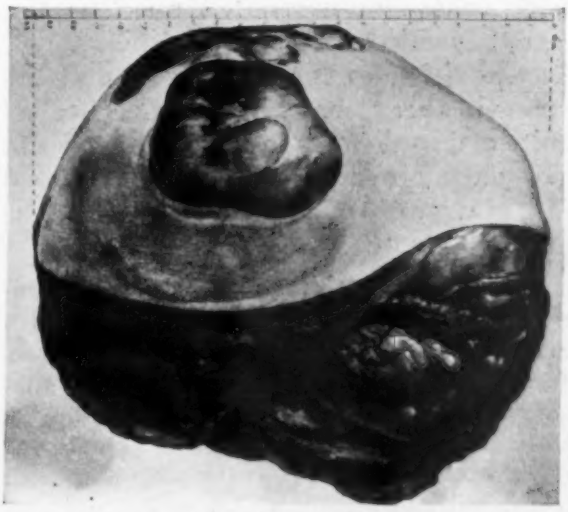

Fig. 1. Drawing illustrating secondary breast tumor which followed total excision of breast two years previously.

adenomas of the liver and thyroid, and adenofibromas and fibroadenomas of the breast.

The breast contains principally epithelial and connective tissue together with blood and lymph vessels, branches of the intercostal nerves together with some sympathetic fibers, and a small amount of unstriated muscle. Angiomas and lymph-

* Submitted for publication March 5, 1929.

angiomas of the breast have been reported. Sonntag reports a neuroma. The occurrence of a neoplasm of the mammary gland containing unstriated muscle is not, then, beyond the realm of possibility.

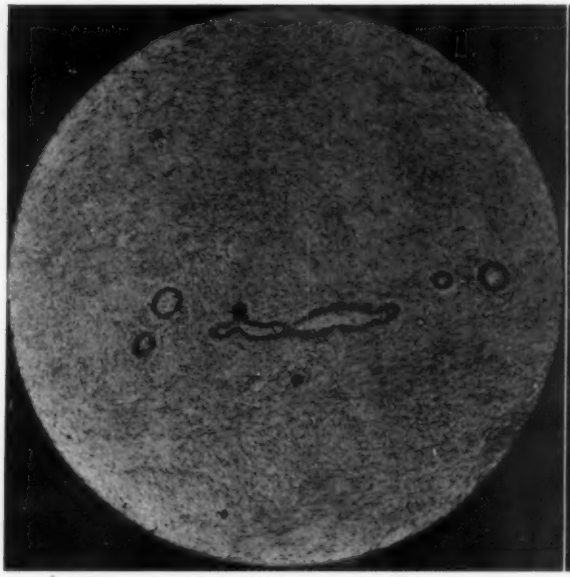

FIG. 2. Section of primary growth.

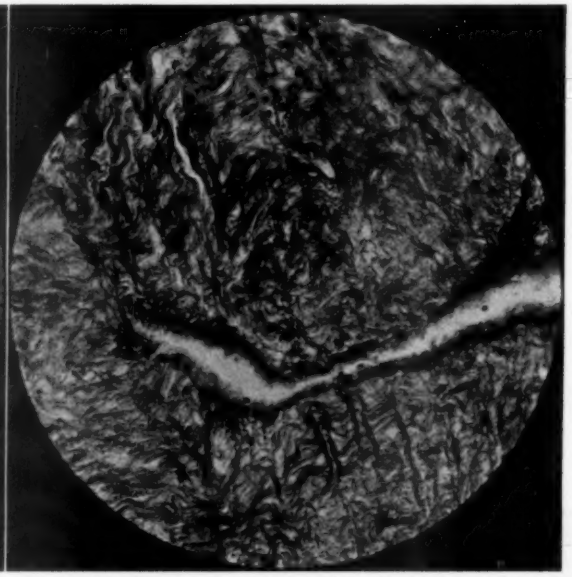

FIG. 3. Mallory's connective tissue stain showing fibroblastic origin of growth.

In addition to the unusual type of the tumor in this case, attention is also called to its extraordinarily large size. The entire secondary growth is irregularly rounded and measures 19 cm. by 18 cm. and is 12 cm. in depth.

Female, aged thirty-five, has had four children, all of which were breast fed. The last child was nursed until the twelfth month. Several weeks later, the patient observed that her left breast was swollen, painful and heavy. Examination disclosed a tumor mass involving the entire breast. The overlying skin was bluish red and adherent. There was a crater ulcer 1 inch in diameter near the nipple. The axillary glands were not palpable. The breast was removed in its entirety. The growth was adherent to the underlying muscles, but there was no axillary gland enlargement. Recovery uneventful. Two years later, the tumor reoccurred, as illustrated in Figure 1. Its growth was more rapid, and even heavier than the primary tumor, and very painful. A second amputation was performed with complete exposure of glandular areas. There was no evidence of gland involvement. The specimen was studied microscopically by several pathologists and reported as follows:

Dr. OSBORNE A. BRINES: The sections examined include portions of stratified epithelium, voluntary muscle and a new growth area in which the histological structures consist mainly of newly formed connective tissue. There are also interspersed muscle cells and tubules lined with epithelium. The same architectural growth plan obtained in sections

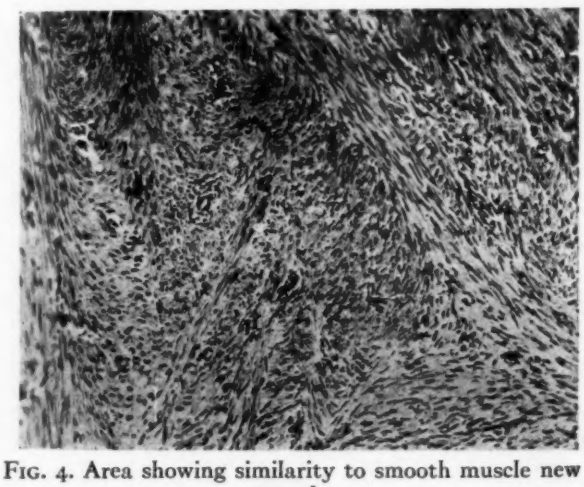

FIG. 4. Area showing similarity to smooth muscle new growth.

taken from varied parts of the tumor mass. Differential staining of the tissue by Mallory's and Van Gieson's method show excess growth of connective tissue, but there is present an interspersing number of muscle cells. The hematoxylin and eosin stain shows to best advantage the differentiation of tubules lined

with columnar or cuboidal epithelium. These tubules are fairly evenly produced throughout the growth. There is very little fasciculated arrangement of the tissue. The growth impulse is fairly rapid. The tissue is infected and on some margins ulcerating.

Dr. James Davis: The section consists principally of fibrous and non-striated muscle tissue with inclusions of apparently normal mammary gland acini. The new growth muscle cells appear young and probably growing rapidly. Diagnosis: Myofibroma of the breast.

Dr. Plinn Morse: The breast tumor is a cellular fibroma of a rapidly growing type, poor in glands. Special staining methods show that the growth is primarily made up of fibroblasts, the glandular elements being very much in the background. It will not metastasize in its present state of growth activity, but will tend to become more malignant, I believe, at successive recurrences.

Dr. F. B. Mallory: Sections show a fairly rapidly growing leiomyosarcoma; the others a much more scirrhous type of growth of the same sort. The fact that the tumor recurred points to malignancy. The original growth may have been an adenoma of the simple or intracanalicular type, then later a leiomyoma which began to grow more rapidly and gave rise to the leiomyosarcoma which is present in the recurrence.

The patient was examined recently and there is no evidence of further growth or metastasis.

SOLITARY CYST OF RIGHT KIDNEY*

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NEWARK, N. J.

IT is my intention to present these cases which appear to me to be of unusual interest and worthy of being recorded, particularly in view of the fact that these patients have been seen recently, almost two years after operation.

I will not take up space in quoting bibliography.[1] Harper's and Cunningham's series comprised 124 cases, 53 of which were right kidney, 49 left kidney, with 50 showing lower pole situation, 33 upper pole, 12 mid-portion.

Case 1. reg. L. O., female, aged sixty, May 2, 1927.

Chief Complaint: Illness began six weeks previous with a cold; patient coughed continuously for one month, and then had pain in side (right). Pain is not always in same locality, but moves about from place to place. Pain is not getting worse. Appetite is poor; digestion fair; bowels constipated; nycturia (2); dysuria at onset, but none at present.

Past History: Pneumonia and chronic bronchitis; no operations; no accidents. Family History: Negative for tuberculosis and cancer. Menstrual History: Menopause, twenty-one years ago. Marital History: 3 children, living and well. History otherwise unobtainable as patient does not speak English.

Physical Examination: Findings in heart and lungs were negative. Otherwise physical examination was negative except for a palpable mass in the right flank the size of a grapefruit, somewhat motile, with some pain on pressure and a feeling of tenseness. A plain roentgenogram of kidney, ureter and bladder was made on April 15, 1927 on order of family physician. The roentgenologist reported that this roentgen-ray examination revealed a large right kidney, low in position with distortion in shape. A pyelogram was found necessary, however, if the nature of tumefaction was desired.

On May 2, 1927 the patient was first seen by me in consultation and a pyelographic study was recommended, which was done on May 4 with the following findings:

Cystoscopic examination: The bladder shows a few trabeculations, the trigone inflamed, the right orifice hypertrophied and inflamed, the left orifice normal, allowing a No. 6

[1] I can refer to the work of McKim and P. G. Smith, *J. Urol.*, December 5, 1924; Young's Urology, Chap. VIII; and Harpster, *J. Urol.*, February 19, 1924.

* Read before the Section of Genito-Urinary Surgery, New York Academy of Medicine, Feb. 20, 1929.

catheter to pass to the left kidney easily with clear urine returning. The right orifice failed to admit the catheter at first but finally on manipulation a No. 6 catheter was passed about 3 cm. There was no urine returned except for an occasional drop, but finally the excretions became a little more rapid. The urine was clear. In view of these findings it was necessary to subject the patient to intermittent dilatations of the right ureteral orifice for stenosis. A pyelogram was made with the hope of causing some of the dye to pass. Following is the roentgen-ray report:

May 6, 1927. Radiographic examination of the genito-urinary tract reveals the kidney on the right side to be large and low in position, the appearance being that of tumefaction of the same. The left kidney is of normal size, shape, position and illumination, with a normal course and outline of the ureter on this same side. The ureter on the right side seems to show ureteral stricture just above its entrance to the bladder. Along the ileopectioneal line on both sides there is evidence of several round, opaque bodies, the appearance of these, however, being that of phleboliths.

Diagnosis: Tumor of right kidney.

On May 25, 1927 a gall-bladder series was negative.

May 30, 1927, the pyelographic study was repeated. This time the catheter passed to the pelvis of the right kidney. Roentgen-ray report:

Radiographic examination of the genito-urinary tract reveals the right kidney enlarged as previously reported, with what might be a compensatory dilatation and enlargement of the major and minor calyces. The ureter on this side is displaced towards the spine, probably due to extrinsic pressure. This mass of the kidney seems to be mainly cortical with pressure and destruction of the pelvic portion. It is also noted that there is considerable atrophy due to lime-salt absorption of the osseous system. *There is also evidence here of a tendency towards low-grade hypertrophic osteo-arthritic changes noted in the lumbar vertebrae.*

Diagnosis: Benign tumor of kidney.

May 26, 1927. Phenolsulphonephthalein test: Time of appearance; left, two and one-half minutes right, ten minutes. Percentage of excretion was: right, 20 per cent, one hour; left, 35 per cent.

The culture report of the urine was negative, both sides.

Urine microscopic examination: Right, few red blood cells and many epithelial cells, few hyaline casts; left, many red blood cells (traumatic), many epithelial cells.

The urine showed practically nothing unusual except an occasional pus cell and intermittent slight albuminuria, no doubt due to the partial stenosis of the right ureter in routine analysis.

Blood chemistry was negative. The blood picture was practically normal except for slight secondary anemia.

Summary: In view of the pyelographic laboratory findings in conjunction with the clinical aspects a provisional diagnosis of possible retention cyst or cyst of the kidney was made.

June 6, 1927. Nephrectomy was performed under gas-oxygen-ether anesthesia, the incision being made in the usual manner. The following is a description of the gross appearance of the kidney:

A large cystic mass was found continuous with the lower pole of the kidney, the lower pole not being palpable. An attempt was made to deliver the cyst intact, which was not successful. The cyst was the size of a grapefruit, and contained about 1500 to 2000 c.c. of serous fluid. The cyst wall was rather thin, about 2 mm. in thickness on the average, with no apparent communication with the renal pelvis.

The wound was closed in the usual manner. The patient made a good recovery.

June 25, 1927. A postoperative cystoscopic study and functional tests were done. The findings were normal. The left kidney functioned very well. The patient was discharged well July 7, 1927.

The pathologist's report is as follows:

Kidney 13 by 4½ by 5½ cm. It has been fixed in formalin, is rather pale. The upper pole is composed of a cyst 6½ cm. in diameter. The kidney is lobular (fetal type); the capsule strips readily but is sufficiently adherent to a rough surface. There are visible on the surface numerous small cysts 2 mm. in diameter up to 6 mm. in diameter. There are also evident upon the surface two solid nodules 5 cm. in diameter. These are yellowish in color and on out-section have a hyaline appearance, and proved to be coagulated material. The large cyst apparently does not communicate with the pelvis of the kidney and apparently is a simple cyst. It contains adrenal tissue which, however,

is probably merely an adrenal rest and not a tumor. The cyst is probably a simple retentional cyst.

Observations: During the course of hospitalization there was noted that the patient had uncontrolled coughing spells, which were no doubt due to the pressure of the mass against the diaphragm on motion. Another factor was the pain in the back, not over the kidney but over the transverse processes of the first and second lumbar vertebrae. The roentgenologist called attention to osseous change in the spine.

It is my desire to call attention to the existing bony outgrowth along the spinal column, the presence of backache three and six months after operation and also to the fact that a patient having this condition after operation may be led to believe that the operation was unnecessary. This is especially true in persons around this patient's age, when such bone changes take place. This fact was explained to the patient's relatives and is a good point to remember, the differentiation of backache, particularly following operations.

Case II. Termatoma testis. J. H. R., aged thirty-eight, admitted to the urological service September 28, 1927. Occupation: iceman.

Chief Complaint: Painful growth in scortum; duration, four years.

Onset and Development: Four years ago a small nodule, the size of a pea, appeared in his scrotum, on the left side on the floor, apparently not connected with the testicle. The nodule progressively increased in size and later became painful. About two or three months ago the patient noticed the tumor was increasing in size more rapidly than ever before. At the same time he felt dull aches along the left thigh and in the back on the left side. He was obliged to give up his work.

Past History: Diphtheria fifteen years previous; influenza one year previous; nycturia (2). Gonorrhea, chancre and syphilis denied.

Family History: Irrelevant.

Physical Examination: General: Well-developed and well-nourished, robust, muscular, white male. Eyes: Right pupil considerably larger than left; left eye received an injury at the cornea-scleral junction some years previous; at the site of this injury in the inferior lateral corner is a scar across the iris. Injury was due to a cut with glass. Both pupils react to L and A. Mouth: Irrelevant. Heart: Sounds do not come through well on account of thick chest wall. Apex beat not seen nor heard; sound of poor quality but regular. No evidence of any valvular disease. Lungs: Normal. Abdomen: Inguinal glands on both sides were palpable. Those on the left side are slightly tender. Genitalia: Right testicle was normal. Left testicle has a tumor attached to its posterior-inferior surface. The tumor is almost of the size of an egg. It is quite hard. It moves slightly at its attachment to the testicle. It is very tender to touch at its testicular junction. Reflexes: Normal.

The patient was placed under observation for one week and complete pyelographic, laboratory and roentgen-ray studies made, which proved to be negative and definite diagnosis of teratoma testis was made, which was disagreed with by four other physicians, their main contention being that it was tuberculosis. Nevertheless operation was recommended and accepted, and on October 7, 1927 operation was performed under gas-ether-oxygen anesthesia and a high left scrotal incision, 8 cm. long, made; scrotal contents were evacuated; there was a hard, round mass about the size of an egg situated near the epididymo-orchidic junction, epididymis was indurated and thickened above this mass; testis solid to touch. Ligation was done high up and frozen section immediately made as a matter of routine. Diagnosis was made by the pathologist. The wound was closed in the usual manner. Iodoform gauze packing was placed in the left scrotal sack; the stump of the vas transfixed to the edge of the wound, as has always been my routine in these operations.

It was noted on operation that the mass was very strongly adherent to the tunica vaginalis; a good deal of difficulty was encountered in freeing it. With this in mind, I was not surprised when five or six days after operation considerable sloughing and necrosis of the wound began. It is apparent that early necrosis had already set in with the breaking-down of the mass and induration of the scrotal wall with no visible involvement of the testis itself.

The second operation was performed to remove this sloughing mass, considerable care being necessary to prevent perforation of the right scrotal cavity. The wound was slow in healing and finally subjected to quartz-light exposure with the result that the wound freshened up and healed without trouble.

Postoperative observation did not reveal any decrease in backache and all forms of

exercise and massage were instituted because I was convinced from the beginning that the backache was occupational, the pain in the left groin and thigh being due to the weight of the tumor.

Repeated observation of the patient the past year and a half has revealed no signs of metastases, with gain in weight and perfectly healed wound. Complete roentgen-ray studies of chest, spine and sacrum were made February 12, 1929, with the following report:

Radiographic examination of the chest for metastasis reveals no evidence of any. The spine in various different areas reveals evidence of a tendency towards hypertrophic osteoarthritis as characterized by sharpening of the articular margins. The upper and outer border of the fifth lumbar vertebra shows evidence of a probable old destructive osteitis with healing.

Comment: It is apparent that so far there have not been any definite signs of metastases and this may prove to be one of those fortunate cases where fairly early surgical intervention has effected a cure.

It is interesting to note that in my recollection deep roentgen-ray therapy was not instituted.

Pathological Examination: Subacute inflammatory process, which could be tuberculosis but cannot be so diagnosed from these sections. Please cut other sections. These sections are well cut and stained. It would be well to see other areas. (F. B. Lynch.) Technician's report on gross appearance: Tissue consists of three oval masses approximately 5 by 3 cm. in size. These are hardened, tough, fibrous tissue, pale white in color and show no injection; they are bloodless. These are attached by a pedicle to the base of the testis. The masses are shiny to touch, cut with resistance, and the cut surface is of the same character and color as outer coats. Culture and smears from pus received from the second operation show no acid-fast bacilli but Gram negative diplococci in smear. These are intracellular. November 9, 1927. Acute suppurative and subacute inflammation of testis and epididymis. No evidence of tuberculosis or tumor in these sections. November 12, 1927. Subacute and chronic epididymitis with necrosis, edema and hemorrhage. Tuberculous epididymitis. There is no evidence of tumor. (F. B. Lynch.)

Tissue approximately 10 by 5 mm. The outer walls are pale in color and present a rough corrugated appearance. The tissue cuts with the same resistance. The cut surface near the outer coats is pale and fibrous like, the inner mucous surface is dark brown and hemorrhagic in appearance. To the touch, this is rough and fibrous like. (F. B. Lynch.)

November 19, 1927. Tissue examination: There is a malignant growth of embryonal gland structures and undifferentiated carcinoma. The gland alveoli are irregular and lined by cuboidal cells with large and hyperchromatic nuclei. These cells also diffusely invade the stroma. Mitotic cells are occasionally found. There are numerous blood vessels intimately associated with the gland structures and the endothelial lining cells of many vessels are very large in the process of active growth. It is difficult in many instances to distinguish such cells from carcinoma cells, although there is little doubt that the latter have invaded blood vessels. Lymphoid deposits, quite constantly present in this type of mixed tumor, are found throughout the growth. Polynuclear infiltration is present in some areas. This embryonal carcinomatous growth is undoubtedly a one-sided growth of a teratoma.

Diagnosis: Embryonal adenocarcinoma of testicle. (John W. Gray, Lewis W. Brown.)

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EPITHELIOMAS ARISING IN SCARS

A CLINICAL DISCUSSION AND REPORT*

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THE development of carcinoma in ulcers located in old scar tissue has been well recognized for many years. The formation of the ulcer was so well described by Marjolin in 1828 that it was commonly referred to by his name. The formation of an ulcer in an old scar exposed to irritation or injury is not surprising nor is it surprising that such an ulcer after a long period of time with impaired blood supply inhibiting the healing process should become malignant. The nature of the scar tissue surrounding the ulcer probably accounts in part for the slow progress the malignant ulcer makes before it gets deep and reaches the muscle planes. Once there it may become well nourished and metastasize rapidly. This furnishes us a guide in the treatment of such malignant ulcers. While they are still surrounded by scar tissue, one does not need to fear their extension to the neighboring glands and therefore may content himself with excision of the growth without removing the glands in every case. This is in spite of the fact that most of these epitheliomas are of the squamous cell type and it is in sharp contrast to the treatment of such epitheliomas not arising within a scar. In this latter type it is important and necessary to remove the glands draining the malignant area.

Speaking of the "Clinical Value of Certain Phases of Cancer," Wood made an interesting statement which has some bearing on this question and supports my contention. I quote herewith:

> I do not for one moment deny that the damage to the terminal arterioles with the resultant diminution in nutrition and the subsequent sclerosis of the connective tissue which takes place under the action of Xray may actually prevent the growth of tumor cells still remaining in the interstices. One of my colleagues, Dr. Heiman, has done an experiment of great interest in this connection. He has shown that a highly virulent carcinoma can be implanted in the center of a slow-growing fibroadenoma of the rat and that the carcinoma remains for the rest of the animal's life incarcerated in the center of this fibrous mass. Only so much of the carcinoma lives as the food supply permits. But if, after months of such incarceration the fibroma is split open and the carcinoma is taken out and implanted in an animal, it shows all of its malignant qualities unimpaired, and rapidly kills its host. This fact, it seems to me, strengthens the position of those who hold that the tissues of the host have no direct destructive action on the tumor cells.

Epitheliomas have been reported as arising in scars of lupus vulgaris, of lupus erythematosis, of traumatic contused wounds, of incised wounds and even in scars of an operative incision.

One case I have to report arose in a different type of scar from the other two, but they have in common the fact that they were all on the extremities and were squamous cell epitheliomas of long duration without involving the lymphatic glands. (For comparison I shall append the history of an epithelioma of the dorsum of the hand that was not situated in a scar.)

CASE 1. This patient, L. M., was a woman aged thirty-six, married, admitted to Dr. Lilienthal's[1] service at Mt. Sinai Hospital, New York, while I was resident October 27, 1914.

Her chief complaint was an ulcer on the left arm of three years' duration.

Her mother died of diabetes. She herself had a breast abscess operated on eight years before.

[1] I am indebted to Dr. Lilienthal for permission to report this case.

* Submitted for publication February 23, 1929.

Her present illness dates back to the treatment of a horn-like growth on the left arm at the site of her present ulcer. The growth had not know what time elapsed between the roentgen-ray treatment and the appearance of the ulcer.

FIG. 1. Case II. Epithelioma in scar of burn, before treatment (June, 1920).

FIG. 2. Case II. Healed seven years after radiation, excision and Thiesch grafts (Nov., 1928).

been treated with roentgen rays and thereby removed. Some time after this treatment an ulcer occurred in the scar and has remained there, growing slowly but steadily for three years.

Physical Examination: Patient is poorly nourished. General examination is negative except for the local lesion. There are numerous telangiectases over the left shoulder and a scar reaching down over the outer side of the lower deltoid and upper biceps. In the center of the scar is an ulcerated area irregular in outline 2 by 1¼ inches. The center is filled with granulations and some slough and the edges are raised and indurated. Glands of the axilla are not palpable.

Operation October 29, 1914: Excision of ulcer with margin, down to muscle. Thiersch skin graft to bed of wound. November 16, discharged, healed.

Pathological Diagnosis: Squamous cell epithelioma (Dr. Mandlebaum, pathologist). The patient was well when last heard from in January 1915.

Comment. It is important to note that this case is not one that can be classified as a roentgen-ray burn or a rodent ulcer from roentgen-ray. It is a squamous cell epithelioma of the same class as the next cases to be reported, namely an ulcer that becomes malignant after a long period within an old scar. Unfortunately I do

The second case belongs to that more common class of epitheliomas originating in scars of burns.

CASE II. Mr. F. D., aged fifty-two, married, admitted June 16, 1920.

At the age of twelve while tending a furnace he was badly burned about the face, both hands, and forearms. Healing was obtained after a long time with good function of the hands although they were badly scarred. The scars occupy the whole dorsum of the hands and forearms and palmar surfaces of the fingers. The scars are thin and moveable and do not interfere with the tendons. For years on the back of the left hand there had been peeling of the scar at one place followed by scab formation and finally an ulcer. For the past six months a doctor has been treating it with salves, solutions and even cauterized it with silver nitrate. When first seen he had an ulcer, roughly butterfly-shaped, 4 cm. by 2 cm. situated in the center of the scar of the back of the left hand. The edge was firm, undermined and raised. The center was foul and indolent. Glands in axilla were not palpable. A specimen removed from the edge of the ulcer showed squamous cell epithelioma.

Radium treatments consisting of applications of 100 to 150 mg. for various lengths of time were given from June 16 to September 29, 1920. These treatments totaled 1925 mg. hr. In December, 1920 the ulcer had become

elliptical, and had lost the constriction in the center. The floor of the ulcer had a firm white appearance; the edges were smooth and no longer undermined. It was decided to excise the ulcer because it became very painful and showed no signs of healing.

Operation February 5, 1921: Whole area excised. Roentgen-ray treatment applied to base of wound and to axilla. February 24, 1921, Thiersch grafts applied; all took and healed promptly.

Pathology: Ulcer without signs of tumor cells. There has been no recurrence to date, February 1, 1929.

Comment. This epithelioma was treated rather vigorously and possibly a little too vigorously with radium. Pathological examination showed the malignancy had been destroyed. Whether the lack of healing was due to too vigorous treatment or to poor reparative quality of the surrounding tissue, I cannot say. It is true, however, that the adjacent tissue being a scar had inefficient blood supply as compared with normal tissue.

Finally, it is very evident from the outcome in this case that there is no objection to treating such an epithelioma by radium therapy to be followed by surgery, if necessary, but because of the inhibited reparative process I would always prefer surgery without radiation unless radiation was only prophylactic in preparation for excision.

It must be remembered, however, that I am discussing only those epitheliomas that arise within an old scar.

Fig. 3. Case III. Epithelioma in scar of burn. Recurrence after first excision and before radiation (Jan., 1922).

Fig. 4. Case III. Recurrence after radiation and second excision (June 2, 1922). Cured by amputation, now well six and one-half years.

Case III. J. H., male, aged fifty-five, married, born in Poland.

January 4, 1922 he complained of an ulcer on the right ankle. In 1896 he had suffered a burn of his lower right leg and ankle with hot metal. About one year before he was first seen by me he noticed a small ulcer in the center of the scar just below the external malleolus. The sore never entirely healed at any time within that year. He had applied iodine, then resinol, and a doctor had treated it for the last four months with salve and a wash. It steadily grew larger.

On December 5, 1921 an excision which proved to be incomplete was performed. December 6, roentgen-ray treatment had been given to the glands of the groin and the base of the wound. Treatment of the glands was repeated January 5 and April 26, 1922. Examination by me on January 4, 1922 showed a well-nourished man, with an ulcer 7.5 by 7 cm. surrounding the external malleolus of the right leg. It was irregularly oval with raised firm edges. The base was firm, clean, and did not bleed.

Course: I first treated this recurrence with radium January 4, and again January 20 and 27, 1922. By February 24 the ulcer was sloughing and painful and therefore I decided to excise it with a wide border. This excision required a stripping of the achilles and peroneus tendons. The wound was left to granulate and radium was applied to its base. March 24 Thiersch grafts were applied to two-thirds of the ulcer and all took, and the rest was covered with grafts on April 10 when a biopsy from granulations at the heel showed a recurrence. This resisted more radium treatments. The recurrent epithelioma together with the grafted

area now measured 15 cm. in diameter and occupied two-thirds of the circumference of the leg just above the ankle. Each excision had been deeper the last one, laying bare the tendons. As the muscle planes were now threatened and excision would have involved their removal, it was decided that the danger from another excision outweighed the disadvantages of an artificial leg. Therefore, on June 2, 1922, an amputation in the middle of the calf was performed. At no time were the glands in the groins palpable.

Patient was last seen December 30, 1928. There was no recurrence.

Comment. This like the former case shows how resistant to radiation this type of epithelioma is and how impaired the healing factors are on account of the surrounding scar. Like the other case it is safe to say that, although radiation was given to the glands, they probably never were invaded, because, as the next case well shows, these malignant cells in a lymph gland are not so easily stopped by radiation.

Case iv. An Englishman, aged sixty, married.

August 4, 1922 he complained of a sore of two years duration on the back of his right hand. It had grown large only in the last two months. It measured 1¾ by 1½ inches and was indurated and raised. The tendons were not involved. This patient looked seventy years of age, bronzed from life as a gardener. His blood pressure was 110/80 and he had pulmonary emphysema and bronchitis and marked sclerosis of his vessel walls.

Radium treatments were given in August and September, 1922. At first the lesion grew smaller and seemed to be healing but in December it was again active and amputation through the forearm was decided upon. This was done under brachial plexus anesthesia December 30, 1922. The axillary glands were not palpable and I could not get his consent to remove them at the same time, so they were given radiation.

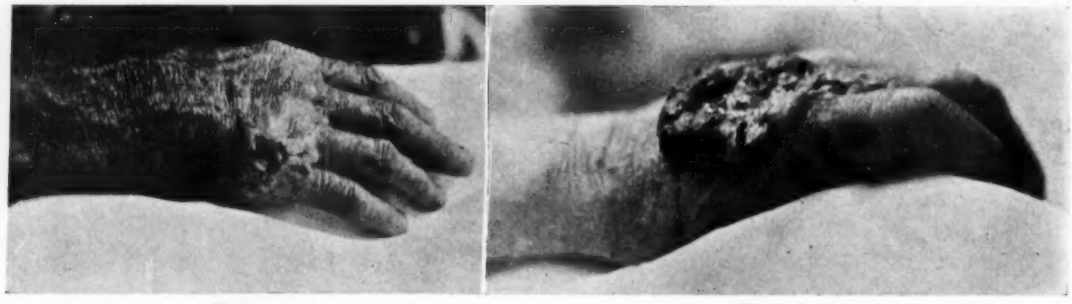

Fig. 5. Fig. 6.

Figs. 5 and 6. Case iv. Epithelioma of hand. Resisted radiation and amputation. Died July, 1925. (Fig. 5, Aug., 1922; Fig. 6, Dec. 30, 1922.)

This patient was perfectly well and happy until March 1924 when I first found an enlarged gland in the axilla. This was removed March 15 and radium needles left in the wound.

A recurrence took place in November, 1924. This patient died of metastases July, 1925.

Pathological Diagnosis: Epidermoid carcinoma probably arising in sweat gland cells. Muscles underlying the malignant ulcer were invaded.

Comment. This case is in great contrast to the 3 preceding in that it was of a type less resistant to radiation, less vigorous in its growth, and yet spread to the glands and metastasized rather early. It is true that this is not a long series of cases but I have reason to believe that they exemplify the characteristics of the two types of lesions. I do not wish to leave the impression that epitheliomas arising in scars never metastasize; for Mohr and Durand each reported such cases.

Johnson ventures the opinion that skin graft in the case of burns may prevent the formation of ulcers by improving the cicatricial tissue. After a carcinoma of the breast is removed and grafts applied to the open area between the flaps (Halsted) skin metastases have been observed in

the true skin at the edge of the flaps but never in the grafts, although recurrences may take place in the chest wall under the grafts. This may have some significance for the prevention of epitheliomas in scars.

Finally, it is just as important in treating persistent ulcers in scars as in treating persistent ulcers on the tongue or lip to excise them early even before they are malignant as the surest way to save the patients from death due to malignancy.

SUMMARY

This report presents 3 cases of epithelioma arising in scars on the extremities. Two were cured by excision and 1 by amputation They had resisted radium therapy. A fourth case of epithelioma of the hand not in a scar resisted radium treatment. The arm was amputated and the patient died of metastases three years later.

It is pointed out that the malignant ulcers arising in scar tissue extend and invade surrounding tissue more slowly than those not in scars.

They are resistant to radiation.

The treatment is early excision.

PERFORATIVE APPENDICITIS

REPORT OF AN UNUSUAL CASE*

Alexander Strelinger, M.D.

ELIZABETH, N. J.

THE description of the following case shows that the diagnosis of such a frequently seen disease as perforative appendicitis may be difficult, when the appendix is misplaced and concomitant conditions are such as to suggest some other disease.

Mr. H. M., thirty-nine years old, was admitted to Sea-View Hospital on October 31, 1927. He said that he had had kyphosis since he was two years of age, but he had never had pain in the region. He also never had any lung trouble. On July 3, 1927 he had pain in both groins; his temperature rose to 103°F. Two weeks later an abscess formed on the right side of the back near the spine in the sacral region. He entered the Cumberland Hospital on July 11; the abscess of the back was incised in that hospital. He stayed there until August 5, 1927, was discharged at that time, receiving hereafter medical attention as an outdoor patient at the Cumberland Clinic. Near the end of October he was sent to the Tuberculosis Admission Bureau, which referred him to the Sea-View Hospital. His abscess in the back discharged all this time, not only through the operative incision but even through another fistula which formed after the operation.

At the admission examination the patient showed kyphosis extending from the seventh cervical to the ninth dorsal vertebra with compensatory lordosis of the lumbar spine. The area of the kyphosis was not tender on direct pressure, on percussion or on indirect compression. There were two sinuses draining the abscess of the back, one of them about 3 inches to the right of the spine, 1½ inches below the iliac crest, the second about 6 inches to the right of the spine and 2½ inches below the iliac crest. The roentgen rays showed some destruction of the 3d to 9th dorsal vertebrae with compression of the 5th to 8th dorsal vertebrae. The lungs showed no definite signs of tuberculosis, sputum examinations repeated eleven times did not reveal the presence of tubercle bacilli. The case was diagnosed as possible tuberculous infiltration of the left apex and Pott's disease of the dorsal spine. The abscess of the back was supposed to originate from the Pott's disease.

Soon after admission in October the sinuses closed, but in the first week of December the temperature of the patient rose to 103°F.

*Submitted for publication March 14, 1929.

and he had intense pain in the region of the abscess. A few days afterwards the abscess broke through the scar of one of the former sinuses, discharging much pus, the temperature returning to the normal. The sinus closed again, reopened and closed again before June, 1928. The patient several times had a temperature about 102° to 103°F. during this period. He also had been constipated through all of this period.

On June 20, 1928 the patient complained of intense pain in the region of the abscess, vomited, had hiccoughs, and his temperature rose to 102°F. Examination elicited pain in the ileocecal region on pressure, but there was no muscular rigidity present. The condition led to the suspicion of an appendicular attack, but the vomiting and the hiccoughs subsided in two hours. In the following three days the abscess filled again, causing intense pain. On June 23 the abscess was aspirated, and pus was withdrawn with fetid-smelling gas. The pus contained colon bacilli but no tubercle bacilli. All this indicated that the abscess of the back originated from a retrocecal, inflamed and perforated appendix, which had not been causing grave symptoms because of its retrocecal position, well isolated from the abdominal cavity, and that the actual condition of the patient had no connection at all with the obviously inactive Pott's disease. As evidence of the correctness of this supposition the abscess spontaneously opened on June 24, discharging fecal-smelling pus containing a few tomato seeds, thus showing that the abscess must be connected with the lumen of the bowel.

Appendectomy was performed on November 10, 1928. An unusually long appendix was found in retrocecal position, the distal end of the appendix reaching to the level of the iliac crest, and being connected to the soft tissues there by strong adhesions at the very same spot to which the fistula of the back led. The removed appendix showed macroscopically at its end inflammation with swelling and thickening and a small communication between the lumen and the fistulous tract. Microscopically the whole appendix presented signs of inflammation.

The drain was removed from the abdominal incision on the sixth day; the wound healed promptly. The sinus draining the abscess closed on the eighth day after the operation perfectly. The patient has since that time been in good health, no fever, the sinuses remaining closed. He gained 16 lb. in the first six weeks after the operation and his constipation is cured.

The condition found at operation proved the correctness of the diagnosis. The prompt healing of fistulae, the absence of complaints and the great gain in weight show that the abscess was not due to tuberculosis, but to the diseased appendix.

I did not find any similar case reported in the literature.

ELEPHANTIASIS OF LOWER EXTREMITIES

SUCCESSFULLY TREATED BY KONDOLEON'S OPERATION*

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LYMPHATIC elephantiasis is a chronic progressive enlargement of a portion of the body, due to a hyperplasia of the connective tissue of the skin and subcutaneous tissues; a hyperplasia of the lymph vessels; and chronic edema of the affected part[18] Hutchinson[6] states that whatever causes obstructive inflammation of lymphatic trunks may, in dependent parts, produce elephantoid hypertrophy.

ETIOLOGY

Formerly, the belief prevailed that elephantiasis was due to lymphatic obstruction caused by filariae. In 1892,

* Submitted for publication March 7, 1929.

Sebouraud[13] published the results of his work in a series of 5 cases. By scarifying the skin during an erysipelatous attack, and culturing the blood and serum thus obtained, he was able to demonstrate pure cultures of streptococci. Elliott[4] shares the same opinion. He cultured a short chain streptococcus, most prevalent beneath the epidermis, around the blood vessels and lymph channels, where the infiltrate was most marked. The pioneer work of Matas[10] in this country contributed much toward the knowledge of elephantiasis from the standpoint of streptococcal infection. He maintains that repeated bacterial invasion is essential, usually by the streptococcus. According to Sistrunk,[15] several patients operated upon at the Mayo Clinic developed elephantiasis independently of venous, or lymphatic obstruction, and solely as a result of repeated attacks of streptococcus infection. Manson[9] says that lymph stasis alone does not produce elephantiasis; the latter is a true hypertrophy of the subcutaneous tissue in which inflammation in an area of lymphatic congestion is prerequisite. In areas which have never become inflamed, simple lymphatic edema readily enough subsides upon pressure or elevation.

The past history of the patient whose case is herewith presented is one long trail of prolonged and repeated bacterial infection; namely, dental infection, furunculosis, pneumonia, suppurative appendicitis, etc. Numerous attempts to isolate the filarial organisms were unsuccessful.

PATHOLOGY

Sistrunk[15] describes elephantiasis as an hypertrophy of the connective tissue elements of the skin, subcutaneous tissues, and deep aponeurosis. The condition usually develops in patients who have an obstruction to either the lymphatic or the venous circulation draining the affected area. Such obstruction may occur from a surgical removal of the lymph glands draining the area; from adenitis; obliterative thrombophlebitis; or lymphangitis. Since the vessels are unable to drain the lymph properly, an edema in the tissues results. Stagnation of lymph in tissues predisposes to infection by microorganisms, usually some type of streptococcus. After such an infection, there follows an obliterative lymphangitis, with a hypertrophy of the connective-tissue elements. As these changes progress, the pathological picture gradually changes from that of a simple lymphedema to one of elephantiasis. In the latter condition, there is tremendous thickening of the dermis; of the connective-tissue trabeculae lying between the dermis and the aponeurosis; and of the deep aponeurosis. The epithelial layer of the skin is thinned out through the stretching of the skin, brought about by the accumulation of lymph in the tissues beneath it. The elastic fibers of the skin are found to have disappeared. The lymph channels which have not been destroyed are markedly dilated, and extravasated lymph is found in the subcutaneous fat. Areas of round cell infiltration are scattered throughout the hypertrophied connective tissue.

Patterson[11] makes note of hyperplasia of the Malpighian layer, hypertrophy of the sweat glands, and an atrophy of the hair follicles. In Elliott's[4] case it was evident that the blood vessels were primarily involved. This was shown by the marked thickening of the walls, the endothelial proliferation and the extensive infiltrate surrounding them. On the other hand, the lymphatics were markedly dilated but showed no appreciable thickening, even though some infiltrate surrounded them.

SYMPTOMATOLOGY

The symptomatology of elephantiasis nostras is characterized by recurrent attacks of erythema of the affected part. A chill and vomiting usually usher in an attack. The temperature may rise to 105° or 106°F: there is considerable pain in the legs and scrotum. The part is suffused with a bright red erythema; the red area is swollen and feels brawny; pitting upon pressure is absent. The

neighboring lymph glands are enlarged and swollen. The inflammation of the skin subsides within a few days to a few weeks; the edema, however, tends to persist. The attacks recur at frequent intervals, as many as six occurring in one year, as in the case I am reporting. In the meantime, there has been a marked hypertrophy of the connective tissue, and true elephantiasis is established.

Between the attacks, pain seems to be the second most constant symptom, varying within wide limits as to its severity. In the cases reported by Southam,[16] Bryk,[2] and Whitehead,[19] it was extremely severe. In Scriller's case, the patient was kept almost continuously under the influence of opiates. In contrast to this, pain was a mild symptom in the cases of Jackson,[7] Thompson,[17] Robinson,[12] Breakey,[1] and others. Sebouraud[13] describes his cases as having little or no pain. Pain may be accounted for by the pressure of the hypertrophied connective tissue upon the nerve endings.

TREATMENT

Shattuck[14] treated a case of unilateral elephantiasis by bandaging and rest in bed. This patient, whose edema was not marked, was considered recovered upon leaving the hospital.

Roentgen ray and radiotherapy have been tried, but found unsuccessful in the treatment of elephantiasis. The patient whose case I am presenting here, received several treatments by an outstanding authority on roentgen ray and radiotherapy. Instead of any improvement in pathology, an amenorrhea was produced at the time (two years ago) which has persisted until now. A course of salvarsan was also administered to this patient, but with no beneficial results.

Carnochan[3] in 1851 ligated the femoral artery to starve the growth. This method has fallen into merited disrepute.

Handly of England in 1908, by means of thread and silk, attempted to drain the obstructed lymph areas into neighboring normal tissue. Two years later he said, "to my mind, lymphangioplasty (as this method was termed) has failed to establish its position in the treatment of elephantiasis."

KONDOLEON'S OPERATION

Lanz[15] of Amsterdam, in 1911 was the first to recognize the deep fascia as a barrier to lymph absorption. Therefore, in order to drain the subcutaneous lymph, he incised the deep fascia on the outer side of the thigh, exposed the femur behind the vastus externus, and introduced strips of fascia between the muscles. Thinking that the bone marrow may help in absorption, he introduced pedicled strips of fascia into the medullary cavity through holes drilled in the bone. The skin was then closed without drainage. The diminution in size of the limb persisted three years after the operation.

But the operation of Lanz, although successful to a great degree, was too mutilating and too difficult a procedure to gain favor very long. Kondoleon[8] followed with a simplified technique of fascial division and removal. A series of successes was reported by him that attracted general attention. He believed that small incisions into the deep fascia were inadequate. By the removal of a large strip (5 to 7.5 cm.) of deep fascia, an anastomosis is established between the supra-aponeurotic, and infra-aponeurotic lymphatics. In his cases, he noted that the lymph stasis occurred chiefly at the fascia lata. Henry[5] disagrees with Kondoleon as to the method by which the excess lymph is removed following this operation. He believes that the superfluous lymph is absorbed by the blood vessels of the muscles, and not by the deep lymphatics.

Technique of Operation. An elliptical incision is made from the crest of the ilium to the external malleolus. On the inner side of the limb, the incision extends from the groin to the internal malleolus. Sistrunk reflects the skin back for about 4 cm., and then incises down to and

including the deep fascia. In the case herewith presented, the scalpel was tilted obliquely, so that a larger width of deep fascia is removed at one time. Where the deep fascia is in intimate relationship with the periosteum, as around the knee joint, the flap may be interrupted and sectioned. Caution also should be exercised here, to avoid incision of the external popliteal nerve, which becomes superficial in this region. This operative accident happened during our fourth and last operation. Bleeding may be profuse, requiring many ligatures, especially on the inner aspect of the limb. A tourniquet was useless when tried in our cases; the brawny, indurated elephantoid tissue being incompressible. Several interrupted chromic catgut sutures are then used to approximate the edges of the deep fascia to the exposed musculature. A continuous plain catgut running suture, reinforced by silkworm-gut tension sutures, closes the skin and fat. I found it necessary to use drainage material in the form of a narrow catheter, for the lower angle of the wound, where serum, lymph and liquified fat accumulated in large amounts. However, most operators omit drainage. One or more transfusions are usually required to replace the blood lost at operation.

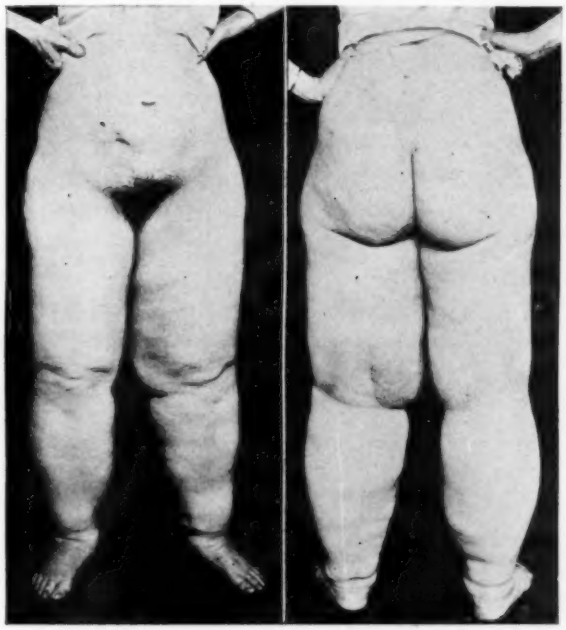

Fig. 1. Fig. 2.

Figs. 1 and 2. Eliphantiasis of lower extremities before Kondoleon's operation, anterior and posterior views.

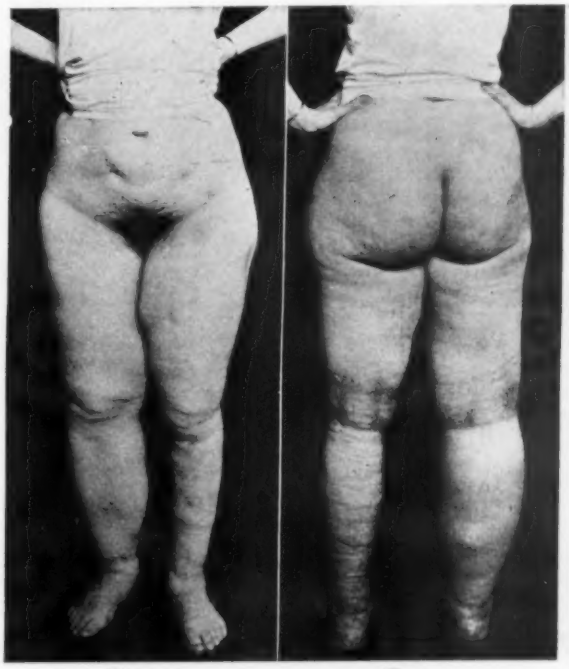

Fig. 3. Fig. 4.

Figs. 3 and 4. Kondoleon's operation upon medial and lateral aspects of left lower extremity. (July 18, 1927.) Note pad of fat of upper inner thigh which could not be removed because of application of tourniquet in this region.

The patient remains in bed seven to ten days, with the limb firmly bandaged and maintained in an elevated position. In fact, rest in bed with bandaging has been advised as preoperative treatment, in order to reduce the size of the limb and blood vessels. But in my case, this preparation caused no change in the vascular supply, as evidenced at operation. It is suggested that bandages be worn for months following operation, until the tissues readjust themselves to this new state.

REPORT OF CASE

Miss T. O., thirty-two years old, was admitted to the Hospital July 17, 1927 for relief of enormously swollen lower extremities. Occupation: silk warper.

Family History: Father died of pneumonia, at the age of fifty-one. Mother, fifty-five years old, living and well. Two brothers, living and well. One sister died of pneumonia. Another

sister is in good health. No member of patient's family has had a serious illness, or any condition similar to her present affliction.

Navy Yard to see the ships newly arrived from the Tropics.

In the year 1918, the patient was suddenly

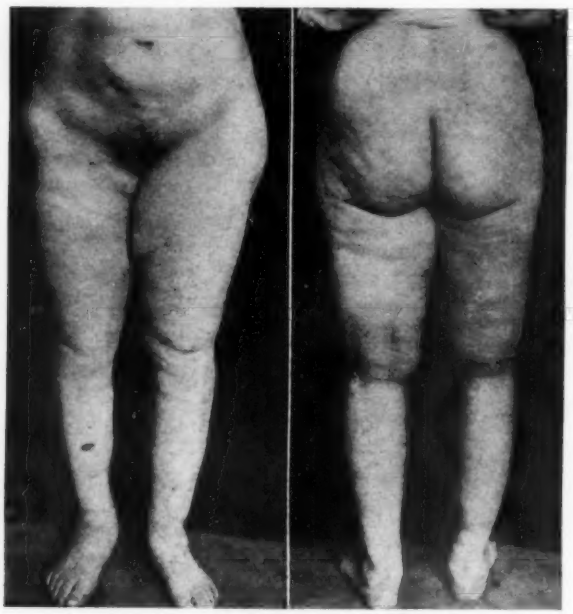

FIG. 5. FIG. 6.

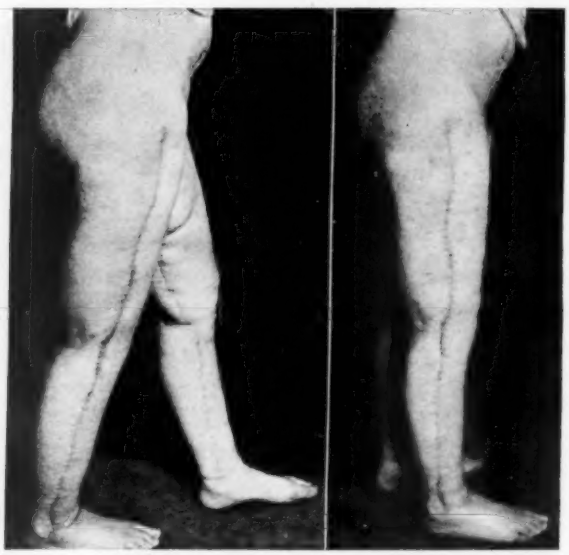

FIG. 7. FIG. 8.

FIGS. 5–8. Result following Kondoleon's operation on both lower extremities. (Jan. 30, 1928.)

Past History: Medical: Varicella at six months; measles when a child. Suppuration of cervical lymph glands when one year of age, leaving present scars. Pertussis at seven years. Numerous attacks of acute tonsillitis up to 1914. In 1918, confined to bed five weeks with pneumonia. Since 1913, has had numerous furuncles and abscesses, many of which required incision and drainage. Vaccine injections were administered for this, but without any appreciable relief. In 1925, seven teeth were extracted for apical abscesses.

Menstrual History: Began at the age of thirteen; occurring every thirty days regularly, and lasting three to five days. Flow of moderate amount and accompanied at onset by some pain in abdomen. Amenorrhea since 1926 following roentgen-ray and radiotherapy.

Gastrointestinal: Complained of indigestion with gaseous eructations since 1914. Constipated and requires the use of cathartics. No complaints referable to cardiorespiratory, genitourinary, or nervous systems.

History of Present Illness: Patient has lived in New York City all her life. Has never been to the tropics. In 1916, she journeyed to Norfolk, Virginia, where she remained three weeks. Here she made frequent visits to the

seized with pneumonia following an attack of bronchitis. This confined her to bed for five weeks. When first permitted out of bed, she noticed her left foot and leg swollen up to the knee. This condition persisted. Twenty months later, patient was taken ill with a ruptured appendicitis. Following this, she noticed her right foot and leg increasing in size. At the same time, both lower limbs were becoming hard to the touch. Treatment, such as bandaging and massage, yielded no relief.

One year later, she experienced her first attack of inflammation: her limbs were swollen, reddened, and warm. The duration of this attack was three days. Gradually these attacks increased in severity, and occurred more frequently. In 1925, there were five such attacks of inflammation, her vulva also becoming swollen and oozing serum and lymph.

I saw her in several attacks of erythema: legs and thighs immensely swollen, reddened and warm when palpated. The inguinal glands on both sides were extremely tender, and swollen. The elevation of temperature reached 105° and 106°F. The patient lay in bed prostrate. Warm moist dressings, codeine sulphate, and salicylates made her more comfortable. Several of these attacks lasted seven to ten days.

Throughout this time, the patient continued to be troubled with furuncles and abscesses, on the arms, back, etc. Relief for her swollen limbs was sought in several large hospitals. Here numerous examinations were made for filariae but without success. Roentgen-ray therapy was tried but apparently was the cause of her not having menstruated since. Bandaging was useless. She found it becoming more difficult to walk because of the increasing size of her limbs, and welcomed the suggestion of operation.

Examination: Patient is a young female, 5 ft. 6 inches in height, and weighs 159 pounds. Examination of heart and lungs essentially negative. On her abdomen, there is a wide appendectomy scar. Her body is of the thin and slender type, as far down as her hip-line, where a marked change takes place. The thighs, legs and feet are enormously swollen with the excess tissue forming large pads and folds, especially about her knees and ankles. Pitting upon pressure is absent, and a brawny hard resistance is felt. (Figs. 1 and 2.)

Measurements: Left calf, 22 inches (57.2 cm.); Right calf, 20.5 inches (53.3 cm.); Left knee 30 inches (78 cm.); Right knee, 28 inches (72.8 cm.).

Laboratory Data: Urinanalysis: Several specimens yielded only faint traces of albumin, few hyaline casts. Stool: Negative for parasites or ova. Blood: Examinations upon numerous occasions, during the day and night, negative for parasites. Hemoglobin: 88 per cent. Color index, 1. Erythrocytes: 4,476,000, leucocytes: 8760. Polymorphonuclear leucocytes: 54 per cent. Large Lymphocytes: 14 per cent. Small Lymphocytes: 26 per cent. Mononuclears: 3 per cent. Transitionals: 2 per cent. Eosinophiles: 2 per cent.

First Operation: Left Lower Limb Lateral Aspect, July 18, 1927:

An elliptical incision was made from the trochanter to just above the external malleolus, excising a strip of skin, 2½ to 3 inches (6.5 to 7.8 cm.) wide, and a strip of fat and deep fascia about 1 inch wider. The thickness of fat was marked, attaining a depth of 3 to 5 inches. Although upon incising the fat no marked bleeding was encountered, lymph and liquified fat exuded in large quantities. The deep layers of the fat were thickened and cicatrized to some extent. The same deep layers of the fat were edematous in certain regions, especially around the popliteal space. The deep fascia was greatly thickened throughout.

After excising the skin, fat, and deep fascia

Fig. 9. Section of tissue removed. Note thickness of deep fascia and fat as well as edema of tissue.

in one maneuver, the musculature, especially of the thigh region, bulged markedly into the wound. Several silkworm-gut sutures were used to relieve tension. The skin edges throughout the length of the incision were approximated by plain catgut. No tourniquet was used. Gas-oxygen-ether anesthesia. Operating time one hour.

Postoperative Course: Temperature never reached above 100.6°F. Pulse never exceeded 100. Two days later, bandages removed; some real edema of the entire lower limb; considerable serum oozing from lower angle.

Nine days postoperative retention sutures removed, patient up and about in wheel chair. Limb smaller in size.

Second Operation: Left Lower Limb, Inner Aspect, August 4, 1927:

Preparatory to the incision, a stout rubber tourniquet was placed below the groin, and

the incision made from the uppermost part of thigh, over the internal tuberosity of the tibia, to just above the internal malleolus. Considerable bleeding was encountered. Same procedure followed as at previous operation. Rubber tube drain inserted in lower angle of wound. The tourniquet was removed before closure of the wound, but no additional bleeding was encountered. Operating time: one hour and fifteen minutes.

Postoperative Course: Convalescence uneventful; patient up and about walking in two weeks. Considerable serum and lymph drained through lower angle of wound. (Figs. 3 and 4.)

Third Operation: Right Lower Limb, Inner Aspect, January 12, 1928.

Same procedure as former operations. Operating time: fifty minutes.

On January 21, 1928, the patient was given 700 c.c. whole blood by Dr. Carl Boettiger. Patient's brother was the donor.

Fourth Operation: Right Lower Limb, Lateral Aspect, January 30, 1928:

Same procedure accomplished as on other side. Operating time: one hour.

In stripping the deep fascia from the musculature in the region of the head of the fibula, the external popliteal nerve was accidently severed. An immediate repair was effected by means of two fine black silk mattress sutures. Denudation of the nerve sheath prevented a nerve sheath approximation. Following the operation, there was anesthesia of the dorsum of the foot, and anterior and lateral aspects of the leg. Dorsiflexion, toe extension, and eversion of the foot were absent. While in bed, a pillow supported the foot. When the patient was up and about, a small brace was worn. Physiotherapy was applied conscientiously. This sensory and motor function did not return until nine months following incision and repair of the nerve. The return to normal was rapid, occupying only two to three weeks. At the present writing nerve regeneration is almost complete. (Figs. 5–8.)

Pathological Report of Tissue Removed: The skin is pale and firm in consistency. The subcutaneous fat consists of coarse lobules. On section the corium is thickened. The fascia attached to the fat and connective tissue septa between the fat lobules is considerably thickened.

Microscopically, the specimen presents an extensive hyperplasia of connective tissue both beneath the epethelia and in the area of the fascia. The connective tissue contains few cells and consists of thick fascicles of collaginous fibers. There is slight mononuclear and plasma cell infiltration in the areas of sudoriferous glands and of small blood vessels. (Fig. 9.)

Pathological Diagnosis: Extensive connective tissue hyperplasia elephantiasis.

CONCLUSIONS

1. An advanced case of elephantiasis of the lower extremities is hereby recorded; operated upon by Kondoleon's method, and steadily improving.

2. The patient's past history of repeated bacterial infection substantiates the recent theory that the streptococcus is the etiological factor. The filariae were never isolated from the blood.

3. Kondoleon's operation is the procedure of choice at the present time.

4. Accidental severance of the right external popliteal nerve, followed by immediate repair, yielded complete regeneration in nine months.

NOTE: I herewith wish to express my thanks and appreciation to Doctors George D. Stewart and Arthur M. Wright for their helpful suggestions and guidance.

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CASE REPORTS BY DR. WILLIAM H. IRISH*

NEW YORK

POTT'S DISEASE

K., a five-year-old school boy, born in the United States, first came under our observation August 22, 1924.

His chief complaint was "a lump in the back," the duration of which was said to be only four months, and dating from a fall. He had no marked pain but there was muscle spasm and rigidity. There was a rather marked kyphos in the lower dorsal region. The diagnosis of Pott's disease was made, and confirmed by roentgenographic examination. This showed a destructive process in the tenth and eleventh dorsal vertebrae.

On August 26, a plaster jacket was applied and the patient was kept under observation. This was removed December 5, 1924, and again on March 20 and August 7, 1925, and January 8 and May 7, 1926. On the last occasion a roentgenogram was again taken; the spine was quite mobile and there was much less spasm, and the roentgenogram showed a healing process.

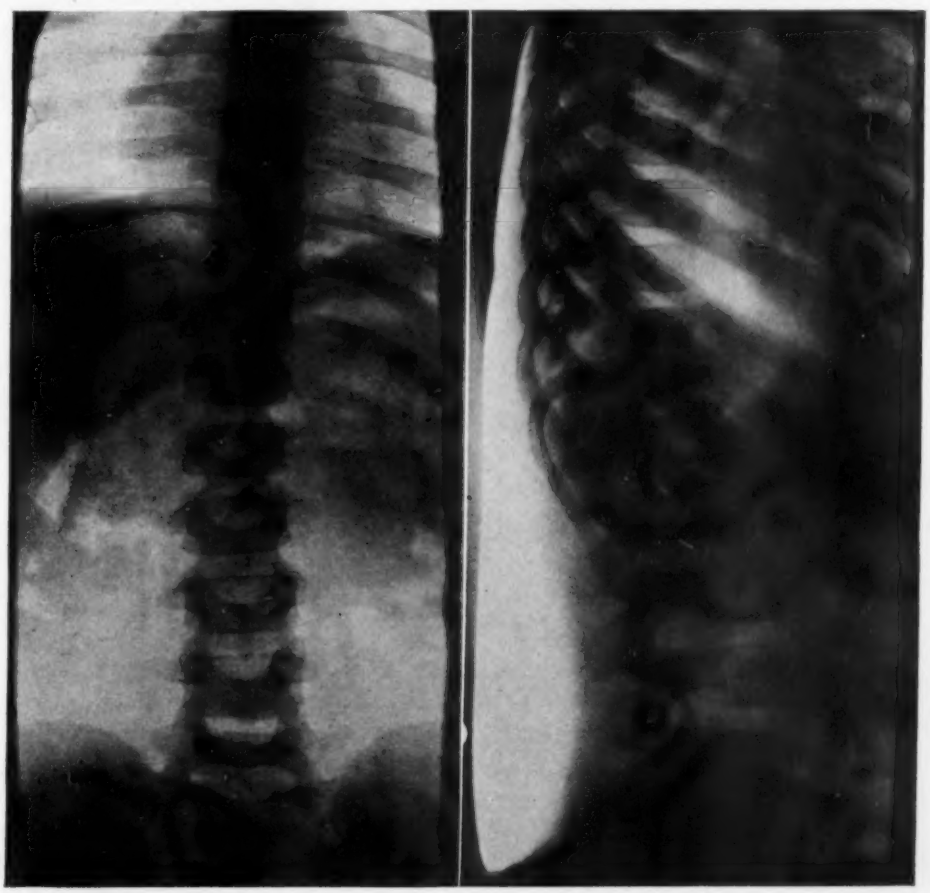

FIG. 1. FIG. 2.

FIGS. 1 and 2. Roentgenograms taken August 20, 1924. Anteroposterior and lateral views.

New jackets were applied on May 11, July 9, and September 1926, and on January 8, 1927. On March 8, 1927 the jacket was removed and the boy was measured for a brace. He continued under observation, being inspected at intervals through 1927 and 1928. On December 7, 1928, roentgenographic examination showed fusion between the bodies of the tenth and eleventh vertebrae.

I believe that this is a true case of Pott's disease. The treatment of this boy

* Read before the Section of Orthopedic Surgery, N. Y. Academy of Medicine, Dec. 21, 1928.

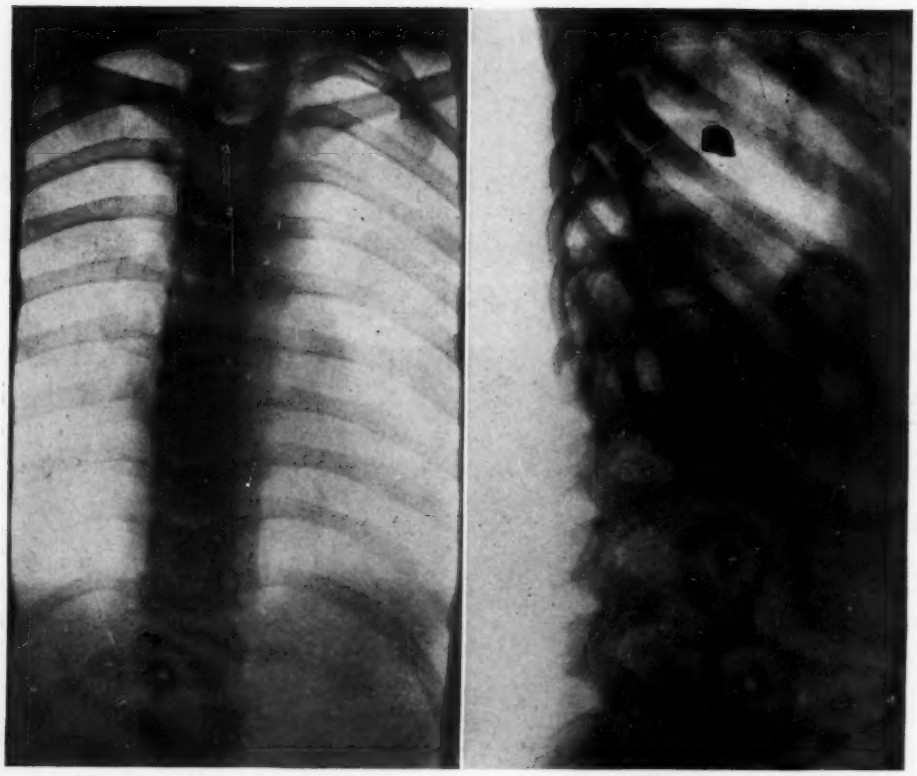

FIG. 3. FIG. 4.

FIGS. 3 and 4. Roentgenograms taken May 8, 1926. Anteroposterior and lateral views.

FIG. 5. FIG. 6.

FIGS. 5 and 6. Roentgenograms taken December 7, 1928. Anteroposterior and lateral views.

has not cost the family thousands of dollars. This boy has been able to go about his daily tasks including school. The family

Fig. 1. Preoperative roentgenogram of left hip. Paralytic dislocation.

Fig. 2. Postoperative roentgenogram of same case, taken September 28, 1928.

is very poor and their home conditions are not of the best by any means, and despite this the boy is getting better. It is certainly a ridiculous fallacy that all cases of tuberculosis of bones and joints have to be operated on to obtain a cure.

DISCUSSION

Dr. Epstein: This spine is perfectly movable; there is not a break in it when he curves the trunk forward; he has no muscular spasm, nor desformity, and he is relieved of the suffering he has been through. He has a spine from which all disease has disappeared; he has two vertebral bodies which have been tampered with by a pathological process, there is no doubt. One of them has extended forward, the result of a process an abscess which softened it when the disease was at its height; the upper one was not much chewed up. An attenuated tuberculous disease may have been present. Dr. Irish said nothing about an abscess there, possibly there was none. There probably was a kyphosis, but it has gone. A number of other mild infectious processes would furnish this picture, and result in complete ankylosis of two vertebral bodies.

PARALYTIC DISLOCATION OF HIP

V. S., a fifteen-year-old schoolboy, born in the United States, first came under our observation November 18, 1927. His chief complaint was paralysis and shortening of the left lower extremity, with instability of the hip and knee.

He gave a history of infantile paralysis fourteen years previously. He had had an operation on the foot at another hospital seven years before coming to us, and subsequently returned to that hospital a few times for treatment, after which the mother took the boy out into the country and he had had no further treatment.

There was a marked paralysis of the left lower extremity and a remarkably unstable hip which could be manipulated in and out without effort; there was no extensor control

of the knee. Roentgenographic examination showed the condition at the hip joint. Operative intervention was decided upon, but because of circumstances the patient was not admitted to the Post-Graduate Hospital until August 1, 1928.

Operation, August 3, 1928: The patient was placed on the Albee table, and the left hip exposed through the Sprengel Smith Peterson incision. The Albee operation was then done, the upper border of the acetabulum pried down, and grafts from the right tibia inserted. The wounds were then closed and a double spica was applied.

On August 17, the patient was discharged to his home in plaster, the portion of the spica which enclosed the right thigh being removed to facilitate his care at home.

On September 28 he was returned to the clinic and the cast was removed. The hip was found to be stable, a roentgenogram was taken, and he was sent home with careful instructions as to the early movement and exercise of the joint. On October 26 he was inspected at the clinic and the hip was found to be in quite good condition.

On December 7 he was again seen at the clinic, and operative procedure for the knee was decided upon.

HEREDITARY WEAK FEET

L. K., a ten-year-old schoolgirl, born in the United States, first came under our observation October 5, 1926. Her chief complaint was a deformity of the feet which had been present since infancy. The feet were markedly flabby, abducted and everted, and a diagnosis of hereditary weak feet was made. Roberts plates and shoes were ordered in an attempt to correct the condition; but a note was made to the effect that operative intervention might have to be resorted to.

The patient was not seen again until May 11, 1928, when she returned to the clinic, reporting that she had worn the plates all the time but that the condition was as bad as before if not worse. The diagnosis of hereditary weak feet was adhered to, and operation was considered.

On June 15, roentgenograms were taken which revealed that there was more to be dealt with than hereditary weak feet alone, i.e. a congenital defect in the left fibula; the mortise of the tibia disarranged and slanting upward and outward; with an underdeveloped astragalus, os calcis and scaphoid.

The patient was admitted to the hospital on July 2, 1928, and operated upon the following day. On the left side the tibial mortise was reshaped as to direction of the slant, removing bone from the tibia only. Arthrodesis of the astragaloscaphoid joint was also performed, utilizing a small sliding graft cut from the astragalus. An astragaloscaphoid arthrodesis was performed on the right foot also, and both feet were placed in plaster casts.

She was discharged from the hospital on July 13, 1928, and reported at the clinic for inspection on July 27. On September 7, the casts were removed and plates and shoes ordered, and she has been seen at intervals in the clinic since December 7, 1928.

DISCUSSION

Dr. Moffat: I would like to know what Dr. Irish did with the mortise? Did he work on the ankle or anteriorly?

Dr. Irish: The tibial surface of the mortise slanted upward and outward complicating the weak foot deformity. Cartilage and bone were removed from the tibial surface, changing this slant so that it was upward and inward, bringing the foot into the overcorrected position.

Query: What was the indication for operation aside from the fishlike appearance? Does the child walk very much better today?

Dr. Irish: If one looks at the child with a surgical mind and compares the way she walks now with the way she walked before, one can understand that she does walk better. The reason that she walks as she does is due to the fact that the feet are in the position of overcorrection, which is purposely being maintained. I feel that it is well to maintain this position of overcorrection for some time.

The indication for this operation other than for appearance. We see a number of cases of weak, flabby feet. It is a type of foot that Dr. Ogilvy has seen fit to term the hereditary weak foot, which is a very excellent description. It is the sort of foot that we often find has been treated for years with plates, shoes, physiotherapy, casts, everything—and yet it persists. It is the type of foot that we see in some adults who come to us with markedly weak flabby feet and all the earmarks of constant foot strain. These started as hereditary weak feet and persisted through growth and develop-

ment. Something must be done for these cases or they suffer in after years. These weak feet do not often respond satisfactorily to treatment. Operation should not be resorted to until there is sufficient bone development in the foot. The best time is from eight to twelve years of age. I feel that this is a frequent mistake in operations on children's feet. Bone operations in the foot where there is more cartilage than bone may result in two things: first more surgical destruction may take place than is realized, and second, with the more cautious, sufficient surgical interference may not be accomplished.

MASSIVE PYONEPHROSIS*

Hubert Lyons, M.D.

NEW YORK

THE patient was a woman of fifty-three, who was admitted to the Urological Service of the New York Hospital January 16, 1928 on account of a protruding mass in the abdomen.

She had been married in 1897, and a few months later became troubled with what she called "gravel in her right kidney" and inflammation of the bladder, and had attacks of pain "like a throbbing toothache" over the right kidney. She had had no frequency, no hematuria, but would be laid up for a day or two at a time. After being under medicinal treatment for five years, she became symptom free. In 1898 her first and only child was born. She had no pyelitis of pregnancy. There was nothing further of interest in the history until August 1926, when she became troubled with nausea and gas in the stomach. In September 1926 she was obliged to go to bed with attacks of abdominal pain, which had the features of gall bladder disease. This was complicated by a definite pleurisy on the right side. The chest was aspirated for empyema but no pus was found. Examination of the chest with a portable roentgen-ray apparatus showed pleurisy. When the patient was out of bed ten weeks later, she noticed a firm, painless lump in the region of the gall bladder, which her physician diagnosed as "hydrops of gall bladder." The lump remained stationary. In August, 1927, she suffered acute pain in the pit of the stomach, associated with much gas. There was no nausea or vomiting. A local doctor spoke of the lump as an enlarged liver. Her symptoms were referable to the liver and she was ill for three days. The mass began to grow a little larger and extended toward the right flank. On October 1 she had another attack of sharp pain in the pit of the stomach, radiating to between the shoulder blades. The temperature was 103.5°F. In twenty-four hours the attack passed away, but the lump remained. An exploratory operation was advised, but the patient decided to try a strict diet first. The mass gradually extended until in January 1928 it had become a prominent abdominal tumor. Roentgenograms taken at this time with special reference to the gall bladder were negative. The question of kidney was then suggested and the patient was admitted to the hospital on January 16, 1926.

She was a healthy appearing middle-aged woman, free from discomfort. The lungs seemed clear except for indications of a high position of the diaphragm, more marked on the right side. Inspection of the abdomen showed a bulging mass in the right upper quadrant, tapering off in a downward direction. On palpation the mass could be outlined from the costal margin above extending down into the pelvis. Laterally, it reached a little beyond the midline of the abdomen; it felt elastic and the surface was irregular, giving a lobulated sensation. About a hand's breadth delow the costal margin a firm border was made out, resembling the edge of the liver. To this point the mass suggested a process either originating in the liver or involving it secondarily.

Rectal and vaginal examinations were negative.

Cystoscopy showed the interior of the bladder to be normal; the ureters were as usual in size, location, and appearance. A lead catheter No. 6 F. was passed on the right side for a distance of 20 cm.; on the left, to the kidney pelvis.

* Read before the Section of Genito-Urinary Surgery, N. Y. Academy of Medicine, Feb. 15, 1929.

REPORT OF URETERAL SPECIMENS

	Right	Left
Character	Cloudy	Bloody
Urea	2 gm. per l	8 gm. per l

PHENOLSULPHONEPHTHALEIN

Appeared	None	4 min.
Per cent	None	11
Time	14 min.	10 min.

MICROSCOPIC EXAMINATION OF SEDIMENT

Wet specimen	Pus 5 h.p.f.	Red cells 25
	Much debris	Epith. 8 h.p.f.

Roentgenographic Examination. The left shadow is normal in size and position; right kidney shadow not made out. There is a large shadow which fills almost the entire right side; the lower border is made out crossing the lower part of the ilium. The catheter on the right side is pushed to the left border of the spine. There are no shadows indicative of stone in the urinary tract.

An attempt to get a pyelogram on the right side resulted in the media extending up the ureter to a point near the level of the left border of the fourth lumbar vertebra.

A complete gastrointestinal series was done. Barium series conclusions: (a) A large mass in the right side of the abdomen which is lobulated in appearance. Its outline strongly suggests tumor of the kidney.

Roentgenographic Examination of the Chest. A marked elevation of the right diaphragm, probably due to a large tumor in upper right quadrant, was shown.

Temperature, normal. Red count, 3,800,000; white count, 7,000; no increase in eosinophiles. The blood picture did not suggest an echinococcus cyst.

Reviewing the roentgenograms the mass seemed most likely to be kidney; it would be difficult to explain such a large mass as originating in the liver, except for an echinococcus cyst which apparently could be excluded. The depth of the mass, pushing the duodenum and ureter well over, suggested that it was retroperitoneal, and in that case most probably the kidney.

The abdomen was explored by the lumbar incision, and the mass was exposed. A cyst, the size of a football, bulged into the entire operative field; the peritoneum opened for a distance of 4 inches, exposing the viscera. The huge size of the cyst made it necessary to open and suction off the contents before going further. It was filled with thick greenish odorless pus, resembling a cold abscess. A culture was taken. The origin of the cyst was not certain; it was attached above to the diaphragm and extended below into the pelvis. The ureter was not located. A specimen of the cyst wall, which resembled kidney tissue, was taken for a pathological report. The cyst was irregular in outline, having several punched-out areas simulating diverticula. The size and attachments were such that resection was not attempted. Before closing the peritoneum an examination of the viscera was made. The liver and gall bladder showed no change, either old or recent. Free drainage was provided and the wound was closed.

Pathological Report. Pyonephrosis. Microscopic sections of the cyst wall showed several epithelium-lined tubules of which the origin is probably kidney tissue.

The patient's condition was critical for forty-eight hours, after which slight improvement was noted; this continued steadily to an excellent recovery.

On February 6, 1928, thirteen days subsequent to operation, a roentgenogram of the cavity was taken after the injection of 10 per cent sodium iodide.

It is now twenty-two days since the operation. The patient is sitting up several hours each day. The wound is closed excepting for a small sinus which drains a slight amount of serous pus. She is ready for discharge.

CONCLUSIONS

1. That silent pyonephrosis may assume tremendous proportions without symptoms referable to the urinary tract.

2. That suspected gall bladder disease which is not susceptible to proof by functional or roentgen-ray methods should be subjected to early urological examination.

SUBCUTANEOUS TEARING INJURY OF JEJUNUM*

REXWALD BROWN, M.D., F.A.C.S.

SANTA BARBARA, CALIF.

INJURIES of the nature herewith described are so rare or so infrequently reported that one hunts through countless pages of medical literature ere he finds report of a similar clinical picture.

Miss M. W., aged nineteen, entered the Cottage Hospital as the result of an automobile accident. She was driving when her heavy car left the road and turned over. She was unable to describe what happened. She complained of severe abdominal pain. Examination revealed a slightly rigid and tender abdomen and a slight bruise on the abdomen 4 inches long extending from the left midcostal cartilage downward and outward toward the left lumbar region. Roentgenograms were taken of the chest and gave no information. The pulse was 80 and the temperature 97.4°F. The red cells were 4,520,000 and the whites 24,300. An hour later the patient vomited, the abdominal pain increased and the abdominal muscles became board-like. Pulse increased to 94. Several ounces of mixed bright red blood and urine were obtained by catheter. What was the injury? Some one of the viscera was certainly torn. We elected to explore the left kidney first in view of the hematuria, the location of the bruise and because abdominal rigidity sometimes occurs in kidney lesions. The kidney was elevated through a lumbar incision. A slight amount of blood extravasation was found in the tissues in and about the pelvis of the kidney, apparently from contusion. A left rectus incision was then made above the umbilicus. The peritoneal cavity was filled with blood. About 8 inches below the ligament of Treitz the jejunum was completely severed. Therefrom a lacerated bleeding wound extended deep into the mesentery. A small amount of intestinal contents exuded from the relaxed severed intestinal ends. No other pathological condition was found.

The two ends of the severed bowel were closed and a lateral anastamosis made between the distal and proximal loops. An end-to-end union was not made because the tear in the mesentery had destroyed the end arteries adjacent to the intestinal insertion and gangrene and necrosis loomed large. As peritonitis seemed probable an enterostomy as a vent for gas and feces was made in the ileum. The patient had a fairly uneventful recovery. Bowels moved normally after a week. She was in a wheel chair on the fifteenth day and went home in three weeks, all wounds healed.

Injuries of the abdomen of a non penetrating type due to physical violence are frequently of serious import. They are, by reason of usage, called subcutaneous injuries. Often there are no external signs to indicate the grave nature of lesions in either or both the parenchymatous or hollow abdominal viscera. Symptoms are varied and early diagnosis is difficult. There are no classical pictures for guidance. Alertness to or delay in estimating the significance of signs and symptoms which arise frequently determines the issue of life or death.

Vance[1] in an exhaustive exposition of subcutaneous abdominal injuries says that injuries of the intestine are relatively infrequent compared with those of the parenchymatous viscera, as the liver, spleen and kidney. The hollow viscera, because of mobility, tend to elude the action of force.

Omitting reference to the stomach and large intestine the small intestine is affected by violence by one of three mechanisms. First, the bowel is compressed between the anterior abdominal wall and a hard area of bone like the spine or pelvis. Second, a tangenital pull on the abdominal wall in the direction of the long axis of the intestine may make purchase on an intestinal coil and tear the lumen near naturally fixed points as the duodenal

[1] Vance, B. M. *Arch. Surg.*, 16: 631, 1928.

* Read before Pacific Coast Surgical Association, Santa Barbara, Calif., Feb. 22, 1929.

jejunal or ileocolic junctions. In this type the tear may extend into the mesentery. Third, the intestine bursts or explodes because violence causes a rise of hydraulic pressure within the lumen and this pressure is sufficient to overcome the resistance of the intestinal wall.

These traumatic lesions of the intestine caused by non-penetrating blunt force are not pleasant to reflect on. The mortality is very high. Nearly all cases not operated upon die; most of those operated upon too late die, and of those operated upon early many die because of the hemorrhage or peritonitis which follows the injury. The lesson to be learned is that early exploration should take precedence over watchful waiting when violent force has been applied to the abdominal wall.

In reviewing the literature, I have been able to find one report only which the case cited above almost duplicates. In this instance there was a fatality from peritonitis.

FRACTURE OF THE INTERNAL EPICONDYLE OF THE HUMERUS*

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NEW YORK

FROM a study of statistics[1] it is evident that of all the different types of fracture of the lower end of the humerus, fracture of the internal epicondyle is the least frequent. This fracture occurs most often in children, because the internal epicondyle unites with the body of the humerus at about the eighteenth year, as shown in Figure 1.

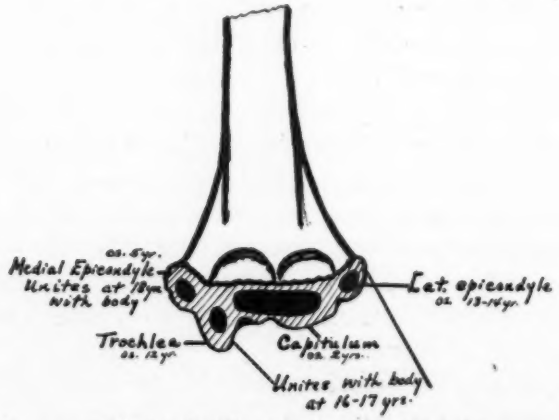

FIG. 1. Plan of ossification, lower end of humerus.

Fracture of the internal epicondyle frequently accompanies dislocation of the elbow, and may be caused by direct or indirect violence. In a few cases recorded, the ulnar nerve has been injured by the original trauma, or irritated by pressure of the displaced fragment or portion of callus. The object of the treatment in cases of this type of fracture is to reduce the fracture or remove the fragment, and to restore the elbow joint to its normal condition.

The following case is that of a fracture of the internal epicondyle with the most unusual displacement of the fragment into the elbow joint.

S. W., male, aged twelve years, fell on his right forearm which was in the pronated position. Seen immediately after the accident, the patient was in slight shock, and complained of severe pain in his right elbow. He also complained immediately of some numbness on the ulnar side of his hand. Examination revealed an irregularity of the inner condyle of the humerus, and an almost entirely locked elbow joint, flexed at about 20 degrees. Stereoscopic radiographs showed a fracture of the internal epicondyle with displacement of the fragment downward and outward into the joint, in close proximity to the olecranon process of the ulna. (Figs. 2–4).

* Submitted for publication April 16, 1929.

At operation, a 3 inch curved incision was made behind the inner condyle of the right humerus. The soft tissues and the internal lateral ligaments were torn across horizontally, and the rent in the capsule extended practically around the entire inner half of the joint, making it unnecessary to enlarge the hole in the capsule to explore the interior of the joint. A roughened area 1 cm. in diameter was found over the inner condyle. The ulnar nerve was seen just posterior to this area, and its sheath appeared infused with blood.

Fig. 2. Anteroposterior view, forearm supinated.

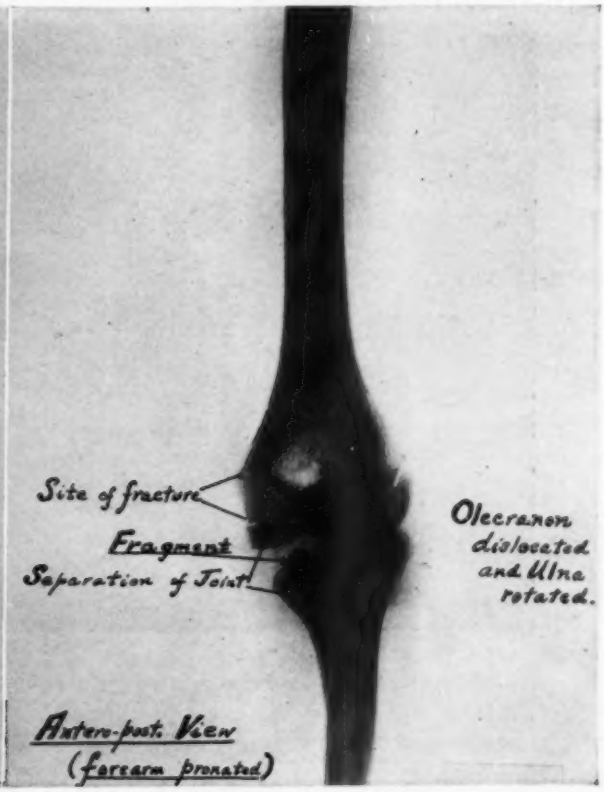

Fig. 3. Anteroposterior view, forearm pronated.

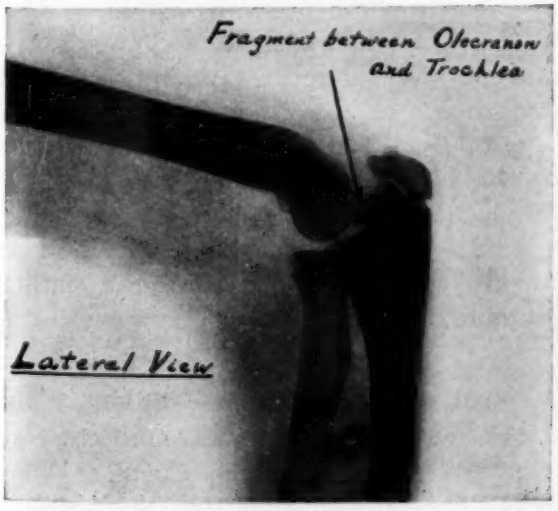

Fig. 4. Lateral view.

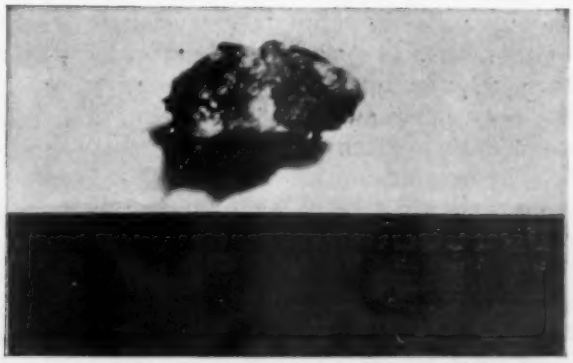

Fig. 5. Fragment removed from elbow joint.

The joint cavity was filled with blood, partially coagulated. The fragment of bone broken off the internal condyle was found about 1 inch inside the joint, with a small part of its attachment to the internal lateral ligament intact. This fragment was removed. (Fig. 5).

The surfaces of the joint were injected and in

places were covered with fibrin. The joint cavity was irrigated with warm sterile normal saline solution until the return was practically clear. The torn internal ligaments and deep fasciae were approximated with chromic catgut, and the roughened area over the inner condyle was smoothed. The ulnar nerve was left in situ. The skin wound was closed with silk; no drain was used.

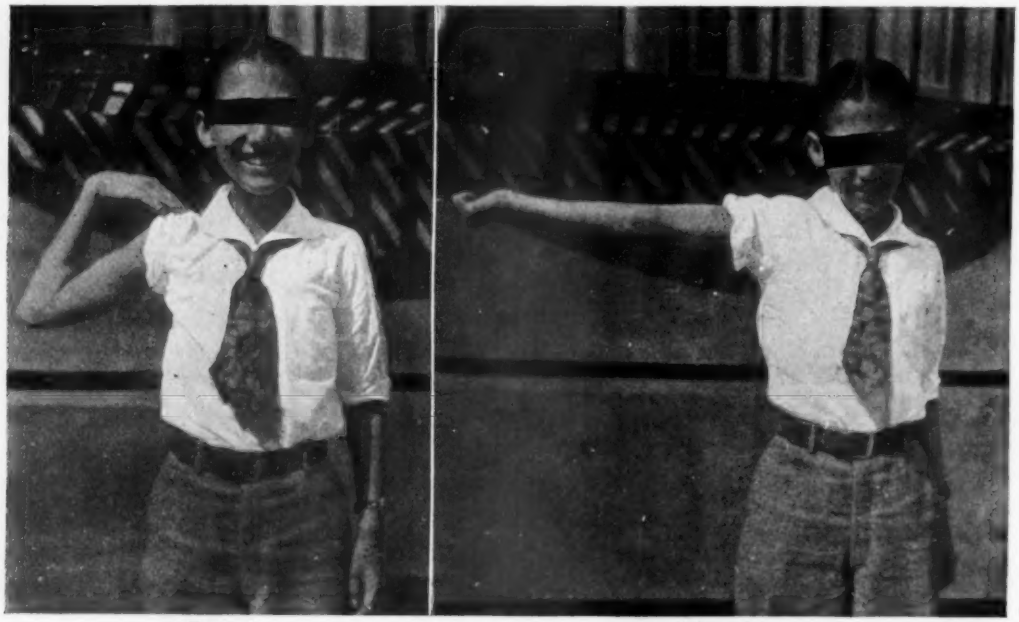

Fig. 6. Fig. 7.

Figs. 6 and 7. Flexion and extension two months postoperative. Complete recovery.

The patient's arm was put up on an open moulded plaster splint in extension for forty-eight hours. The arm and forearm were then passively manipulated, at first very gently for only a few minutes, but increasing a little each day. For ten days the forearm was put up in semiflexion on a posterior moulded splint when not being manipulated. Following this, he received frequent active and passive manipulation, baking, massage, and faradic stimulation of his muscles, so that at the end of six weeks, the patient had full range of motion at the elbow joint. (Figs. 6, 7).

The boy went to camp for the summer and was advised to partake of the various sports, as tennis and rowing. Upon his return, he had perfect function of the joint, and had no aches or pains. He had developed the muscles of his arm considerably, and used it as if nothing had ever happened to his elbow. He had a useful, stable elbow, with full range of motion.

CONCLUSION

1. Early operation and removal of fragment of bone from the joint cavity, before there is extensive injury to the joint surfaces, is imperative in this type of fracture.

2. Complete washing of the joint cavity free of fibrin and blood clots lessens the tendency towards adhesions.

3. Early and frequent manipulation of the joint, first passive, and then active and passive, is important following the operation.

4. Muscle tonus should be preserved by baking, massage, and faradic stimulation.

5. The patient should be encouraged to use the elbow joint at the earliest possible moment.

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ACUTE SUPPURATIVE APPENDICITIS COMPLICATING PNEUMONIA*

JOHN R. HARGER, M.D., F.A.C.S. AND S. ROY ROSENTHAL, M.D.

CHICAGO

MOST diseases present certain complications but an acute ruptured appendix with general peritonitis rarely complicates pneumonia. That the onset of pneumonia in children may closely simulate appendicitis is a well-recognized fact.

We believe the following case report illustrates how acute appendicitis with rupture may complicate pneumonia. However the failure to get a report on the culture taken from the peritoneal exudate, and the inability of the child to give a detailed account of his condition leaves us without positive proof. Yet with the presence of both conditions, and the history given by the mother and the physical findings leaves little chance for error.

B. L., male white child, aged three and one half years, entered the hospital with a history of an acute illness of thirty-two hours, duration. Sudden onset with a slight chill, "bellyache" and vomiting (after taking castor oil). The child was confined to bed and symptoms gradually grew worse, yet had a fairly comfortable night. The next day he vomited all food soon after eating and *four hours* before admission to the hospital, he developed a sharp pain about the naval which seemed to radiate to both lower quandants and persist, being more marked on the right side.

Physical Examination. An acutely toxic patient with labored, catchy breathing, thoracic in type, with a rate of 60, pulse 120 and temperature 100.4°F.

The essential findings in the chest were diminished resonance over the left upper lobe anteriorly, extending from the second to fourth ribs and from the left border of the sternum to the midaxillary line. Bronchovesicular and bronchial breathing were present in this area, with scattered fine moist râles. The abdomen was slightly distended, quite tympanitic and tender both on superficial and deep palpations. Tenderness more marked in right lower quadrant. There was a corresponding rigidity that persisted on deep inspiration and auscultation revealed an absence of peristalsis. There were no palpable masses, and liver, spleen and kidneys were not palpated. Rectal examination disclosed a very tender mass on the right side. Thighs were flexed.

W. B. C. 36,950 with excess polymorphonuclear leucocytes. Urine not obtained at this time but subsequent examinations were negative.

Diagnosis. Upper left lobar pneumonia, with appendix probably ruptured.

Operation. We operated upon the child under nitrous oxide anesthesia using a right rectus incision 2 or 3 inches long. Upon opening the peritoneum a thin gray, purulent material exuded, which was without odor. Appendix was found at pelvic brim, free from adhesions and was simply ligated and removed. Three cigarette drains were used and no attempt was made to close the wound.

Postoperative Care. Fowler's position, hypodermoclysis and hot packs to abdomen. Postoperative course was moderately severe, temperature ranging from 100° to 102°F., respirations 40 to 60 and pulse 120 to 140. For four days the chest findings persisted unchanged, then temperature, pulse and respiration gradually returned to normal and the chest findings disappeared. The abdominal wound continued to discharge for fourteen days, closing gradually without suturing.

Pathology. The appendix was gangrenous near the tip where it contained a large fecal concretion. A culture taken from the peritoneal exudate was misplaced and thus no report obtained, and a portable roentgen-ray plate of the chest was unsatisfactory.

Differential Diagnosis. Several pathological conditions in the abdomen were considered, among which were the following:

* From Surgical Service at Cook County Hospital. Submitted for publication April 2, 1929.

1. Early pneumonia simulating appendicitis.
2. Pneumococcus peritonitis.
3. Appendicitis coexistant with pneumonia.
4. Appendicitis due to pneumococcus infection from the lung.
5. Intussusception complicating the pneumonia.

We believe that in this case we were dealing with a primary upper lobe pneumonia with hematogenous infection in the appendix, damaged by the fecolith which produced a *locus minoris resistentiae;* that, as often occurs in appendicitis in children, rupture of the appendix (at the site of the fecolith) and general peritonitis occurred in six to eight hours after onset.

CONCLUSIONS

A thorough examination of every patient is paramount.

A nervous, restless child, suffering from pneumonia, offers one very little cooperation in making a diagnosis of an acute surgical abdomen. However with sufficient positive evidence, as in this case, operation is not only justified but demanded.

Careful review of the findings by the internist and surgeon in these cases is important, and an exploratory laporatomy under favorable conditions may be indicated, in the absence of positive conclusions, where delay points to disaster.

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EDITORIALS

WHAT HAS BECOME OF THE CLINICAL TEACHER?

IN traveling from University to University, studying the plan of clinical instruction which is being given to the present day student of medicine, and coming in contact with the men who are giving this instruction, one cannot help but be impressed with their lack of clinical knowledge and observation and of their ignorance of therapeutics.

The laboratory, in almost every instance, has replaced the clinician, and while there can be no question as to the corrobative value of laboratory findings, the picture of disease presents certain stigmata which are always present if one is trained to observe; but this, the present day medical student is not trained to do.

The human side of the practice of medicine has passed; the patient is a case and the study completed by operation or autopsy or else the patient recovers and becomes a clinical liability, going from clinic to clinic, office to office, receiving a new scientific suggestion in each.

Diagnoses are made by laboratory tests, roentgen-ray examinations, metabolic readings and biochemical studies, all of which are of great scientific interest to the physician, and the students—but frequently result in little or no relief for the patient.

Our larger University Medical Schools, many of which are subsidized by the Foundations, have almost of one accord, accepted for the Clinical Chairs, young, full-time men who have had little or no clinical experience except that obtained from their hospital residency. Many of these men have the basic training to be good clinicians, had they the opportunity to make the contacts of general practice, or special practice where their livelihood

was dependent upon the satisfaction given the patient, rather than their scientific satisfaction, and interest in the peculiar case.

Teaching by such men robs the student of that one essential in the art of medicine—the art of inspiring confidence.

The great teachers of the past of clinical medicine and surgery, inspired their students and taught them from their wide experience—they cultivated powers of observation and impressed upon them the clinical picture of disease.

Recently one of our Universities appointed as Professor of Obstetrics and Gynecology, a man of but four years training; another placed at the head of its department of surgery a man who is but five years out of college. What type of practitioner do these Institutions expect to turn out? for the man in the field, out on his own, must meet conditions which are never found in a hospital ward. Can we say that the laboratory, research and hospital routine makes up for this lack of experience? It is only by experience that we can gain judgment, and, in the last analysis-it is the judgment of the practitioner for which the patient pays.

John Osborn Polak.

GRADUATE READING

Raymond Pearl, Director of the Institute for Biological Research, Johns Hopkins University, wrote a book in 1927, "To Begin With . . . Being Prophylaxis Against Pedantry,"[1] which we recommend to every teacher of graduate medicine.

This little book began as a magazine article entitled "The Reading of Graduate Students," and appeared in *The Scientific Monthly*. In his Preface, Doctor Pearl says: "For the kind of suggestions contained in this book there is a distinguished precedent. An earnest young student once asked the great Sydenham for advice as to what he should read to lay a sound foundation in medicine. To which request the wise old epidemiologist answered, 'Don Quixote.'"

In this delightful expression of Pearl's opinions he writes at the beginning of Chapter II: "In theory, at least, that special kind of intellectual activity which we call graduate study and in so doing emphasize the least important of its milestones, should give its practitioner a comprehensive, justly balanced, and critically related knowledge of the particular field whose charms have seduced him." From this foundation Pearl gives in detailed outline a course in reading for the student in biology, the books the student should know first hand to round out his education and give him the proper perspective and cultural background of his calling.

He entitled Chapter III "Underpinning." The first book recommended is "De Rerum Natura" by Titus Lucretius Carus, because he was a pioneer in freeing mankind from the bondage of priesthoods, and the superstitious fear of nature which is their sustenance. The second book is "Questiones Naturales" by Lucius Annaeus Seneca. There follows Aristotle's "Historia Animalium," L. J. Henderson's "The Order of Nature," Lucian of Samosata's "Vitarum auctio" and "Piscator," A. N. Whitehead's "Science and The Modern World," George Henry Lewes' "A Biographical History of Philosophy," and works by Réné Descartes, William Whewell, Gustave Flaubert, Karl Pearson, Henry Thomas Buckle and many others. We are attempting no resumé of this valuable monograph. From the suggested outline of books beginning with the simple cultural ones and leading gradually to the more weighty tomes directly concerned with the specialty under considera-

[1] N. Y., Knopf, 1927.

tion one, even though he has no interest in biology, gets a hundred hints as to the method of opening the way to a graduate student and his reading that will make him a well-equipped and very full man.

As we said before we urge every teacher of medicine in any of its branches to read Pearl's little book.

Then, we would enjoy seeing parallel lists suggested for graduate students in the various branches of medicine. We would like to peruse a list of books the graduate student in internal medicine should read; the ones necessary to becoming a neurologist, or the ones essential to the man doing graduate work in surgery, obstetrics or gynecology, or any of the other divisions of medicine and surgery. What are the factors of one becoming thoroughly trained in his calling? What should be the scope of his reading? What is it that constitutes his scientific and cultural background?

Should some who have read this and who know or will know "To Begin With" attempt such an outline, with appended reasons for each book recommended, for graduate students in a medical or surgical specialty we would welcome such material and, no doubt, be glad to publish it.

T. S. W.

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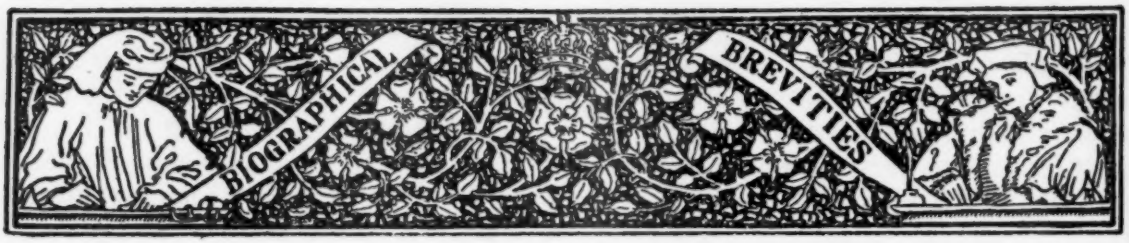


"MECKEL'S DIVERTICULUM"

IN considering the anatomist to whom abdominal surgeons owe a debt, one has to consider the family as a whole. The history begins with the grandfather, and continues with his son, and two grandsons, all brilliant Prussian anatomists and men of parts.

The grandfather was Johann Friedrich Meckel, called The Elder. He was born in 1724 and died in 1774. He hailed from Wetzlar and graduated at Göttingen. At his graduation he gave a notable dissertation on the fifth nerve, since known as Meckel's ganglion. He became the professor of anatomy, botany, and obstetrics at Berlin, a peculiar combination in view of our present-day conceptions. He was the first teacher of midwifery at the Charité. Also, he was the first to describe the submaxillary ganglion.

These accomplisments would have been sufficient to endear him to posterity without leaving to the world a son, Philipp Friedrich Meckel (1756–1803) of Berlin. Philipp graduated at Strassburg in 1777. He became professor of anatomy and surgery at Halle in 1779. He was also the editor, from 1789 to 1795, of the *Neues Archiv der praktischen Arzneykunst*. We learn that he was the favored obstetrician at the Russian court.

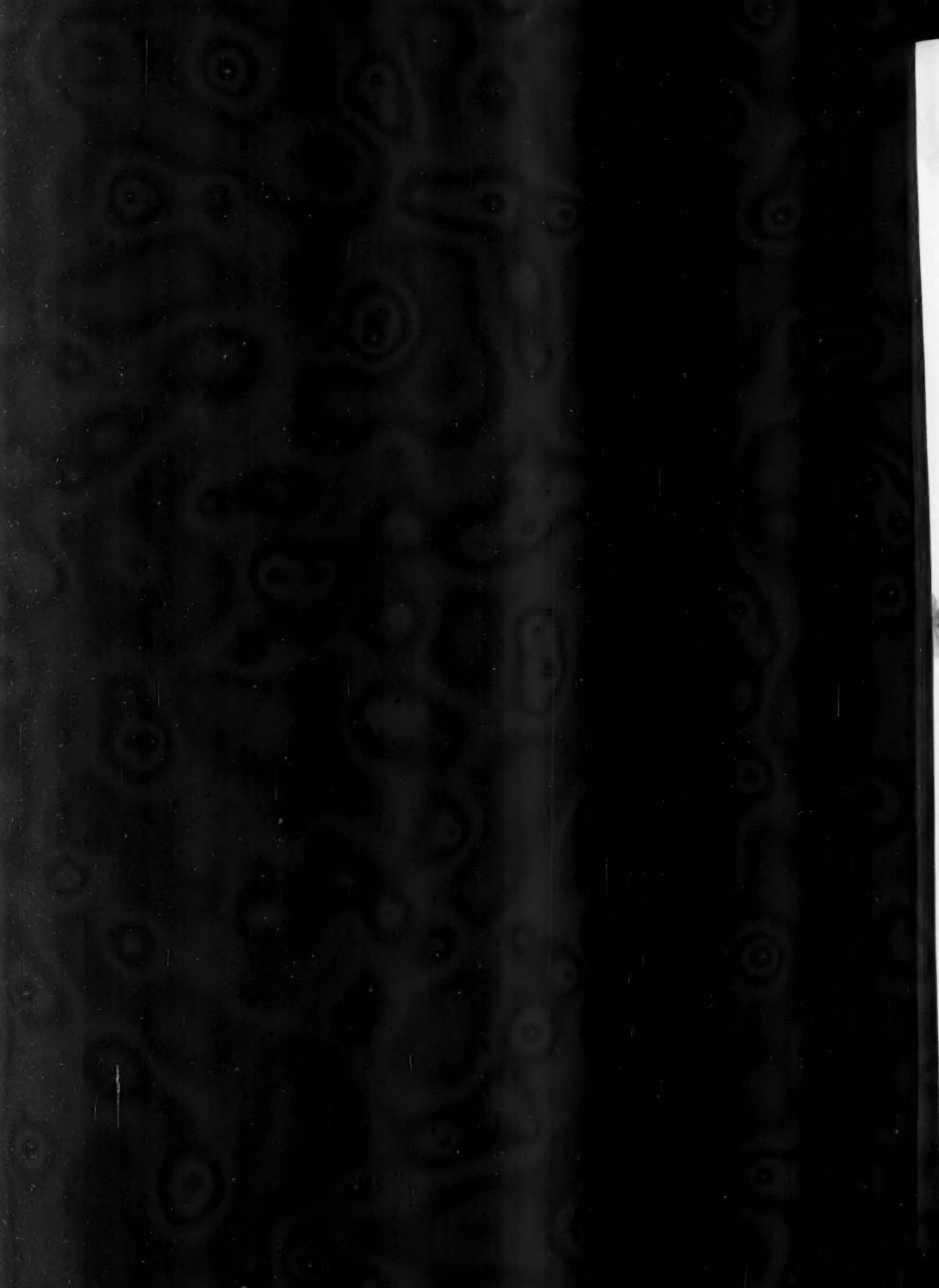
He had two sons, one of whom outdistanced any other member of his family. Of the younger of these sons (August Albrecht Meckel) history relates little except that he became professor of anatomy and forensic medicine at Bern in 1821. He died eight years later.

The older son, Johann Friedrich Meckel, was born in 1781. He became an eminent pathologist and the greatest comparative anatomist in Germany before Johannes Müller. We read that he has been called the German Cuvier.

He wrote at great length but his more important works were his treatises on pathologic anatomy (1812–18), normal human anatomy (1815), an atlas of 33 plates representing human abnormalities (1817–26), and his greatest achievement, his system of comparative anatomy (1821–30).

Johann Friedrich Meckel translated Wolff's monograph on the development of the intestines. He is known to most physicians as the discoverer of Meckel's diverticulum of the intestines.

He died in 1833. T. S. W.



JOHANN FRIEDRICH MECKEL

[1781-1833]

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

STALKERS OF PESTILENCE

WADE W. OLIVER, M.D.

BROOKLYN, N. Y.

PART III*

THE SEVENTEENTH AND EIGHTEENTH CENTURIES

THE SEVENTEENTH CENTURY

HARVEY (1578–1657). *The Pioneer Physiologist.* Just as Vesalius, in the sixteenth century, marked an epoch by his anatomical researches on the organization of the human which were to undermine the Galenic teachings and establish modern anatomy, so in the seventeenth century Harvey's demonstration of the circulation of the blood signalized the epoch of the beginnings of modern physiology. Between the discoveries of Vesalius and Harvey, the teachings of Galen received their death blow.

William Harvey was born in Folkstone, England, the son of a prosperous Kentish farmer. He studied at Cambridge and then at Padua, in Italy, as a pupil of Fabricius and Casserius. Unlike Vesalius, who published his monumental work at the age of twenty-eight, Harvey delayed publication of his great classic, "Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus" (An Anatomical Disquisition on the Movement of the Heart and Blood in Animals), until 1628, when he was fifty years of age, and twelve years after he had first begun lecturing on, and demonstrating, his revolutionary ideas. In the beginning of his treatise he calls attention to the many errors and inconsistencies of the Galenical theory, and bravely states that wise men must learn anatomy, "not from the decrees of philosophers, but from the fabric of nature herself." Then, in the body of his treatise, he proceeds to give an almost faultless solution of the fundamental physiological problem of the circulation of the blood, a solution which lacked completeness in only one particular, namely, the discovery of the capillary channels. Harvey, with his weak magnifying glasses, described all there was to see, and it was not until 1661, four years after Harvey's death, that the newly invented microscope revealed to Malpighi's eyes the microscopic channels through which the blood passes from the arteries to the veins.[33]

What Harvey actually proved can be recapitulated in the following manner: (1) that the ventricles of the heart are distinct muscular sacs which propel the blood that they contain into the aorta and pulmonary artery; that it is the contraction of the heart, and not its dilation,

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which coincides with the pulse; (2) that there are no pores in the septum of the heart, as had been contended by Galen, but that there is a complete circulation of the blood, i.e. the whole blood in the right ventricle is sent through the pulmonary artery to the lungs, is returned by the pulmonary veins to the left auricle and thence flows into the left ventricle; that the whole blood in the left ventricle is again sent into the arteries to the tissues, then round by the smaller veins into the venae cavae, and by them to the right ventricle again; (3) that the arteries and veins contain not air or ethereal spirit, as had been maintained from the time of Galen, but blood; that the blood on the right side of the heart, though mixed with air, is still blood; (4) that most of the blood supplied to the tissues by the arteries runs through into the veins, and (5) that the heart, and not the liver, is the dynamical starting point of the blood.

Pioneer Microscopists. The seventeenth century, which gave to the scientific world Harvey's profoundly important demonstration of the circulation of the blood, also witnessed the rise of the pioneer microscopists. Although, as we shall see, Harvey's discovery brought about a more immediate change in the habits of medical thought and in the concepts of the nature of disease processes, yet the microscopists of the seventeenth century, by enlarging man's vision, prepared the soil out of which sprang the epochal microscopical discoveries of the nineteenth century. Just as Galileo, a contemporary of Harvey, and his telescope widened man's vision of the infinite starry vast of the sky, so did the pioneer microscopists give man a glimpse into the hitherto invisible world of the infinitely small.

Kircher. Apparently, the earliest of the pioneer microscopists was the Jesuit priest, Athanasius Kircher (1602–1680) of Fulda, who is considered by some authorities to have been the first to employ the microscope in investigating the causes of disease. He employed a 32-power microscope and in his "Scrutinium pestis," published in Rome in 1658, he details experiments which he performed upon the nature of putrefaction. He showed how maggots and worms develop in decaying material and described countless broods of "worms" in the blood of plague patients, which he claimed were invisible to the naked eye, but could be seen with the aid of his microscope. Whether these "worms" which Kircher saw in plague blood were red blood cells or white blood cells or even perhaps large secondary invading worms or maggots, is difficult to say, but it does seem rather improbable that, with a 32-power microscope, he could have actually seen plague bacilli. Regardless of this, Kircher would appear to have been the first to state explicitly the doctrine of a *contagionum animatum* as the cause of contagious disease.

Following Kircher, the pioneer microscopists were Hooke and Grew in England, Malpighi in Italy, and Swammerdam and van Leeuwenhoek in Holland.

Hooke and Grew. Robert Hooke (1635–1703) was a mechanical genius, who, among other things, invented a rather complicated compound microscope; in addition, it is probable that Hooke's "Micrographia," published in London in 1665, helped to inspire Nehemiah Grew's studies on the microscopic structure of plants, which are contained in his treatise "Idea of a Philosophical History of Plants" (1673) and "Anatomy of Vegetables" (1682).

Of more far-reaching importance was the work of Malpighi and Swammerdam and van Leeuwenhoek.

Malpighi (1628–1694), the founder of histology and the father of descriptive embryology, is noteworthy for the monumental discoveries he made serenely and gently under the lash of caustic criticism and even persecution.

He appeared at an epoch when such giants as Vesalius and Harvey had overthrown the universal confidence in the authority of the ancients, a period when there was suddenly work to do with no appeal to precedent, when

the microscope suddenly threw open the enormous field of the minute and invisible, to the searching eye. Letters had fallen to a low ebb, ignorance was vast and overwhelming, and despite the brilliance of the preceding centuries, writers were given over to bombastic ornamentation of their writing, but a few honest and bold spirits turned from authority to nature, exact science arose.[34]

In 1661, in his greatest book "De Pulmonibus," he demonstrated the structure of the lungs, in which he stated that they were composed of lobules, intercommunicating with the trachea, and surrounded by a vascular network; he also stated a tolerably correct conception of how the air and blood are brought together in the lungs. In 1660, he described the capillaries and recorded, for the first time, the actual observation of the passage of blood through the capillaries of the lung and the mesentery of the frog. The Malpighian layer of the skin, which he was the first to describe, as well as the Malpighian bodies of the kidney and spleen, are immortal verbal testimonies to his anatomical contributions, described in his "De Viscerum Structura," Bonn, 1666; while his "De Formatione Pulli in Ovo" (1673) and "De Ovo Incubato" (1673) entitle him to the title of "the father of descriptive embryology."

Jan Swammerdam (1637–1680) was the first to see and describe the red blood corpuscles (1658); in 1664 he discovered, by the use of slender glass tubes, the valves of the lymphatic vessels, and in 1677 he devised the method of injecting blood vessels with wax. He also definitely opposed the current idea of the spontaneous formation of life.

Leeuwenhoek (1632–1723). And now we come to a contemporary of Malpighi and Swammerdam, a pioneer microscopist of the seventeenth century who, among his other bids to fame, was the first to see and accurately describe bacteria. Anton van Leeuwenhoek was born in Delft, Holland, the son of a family of well-to-do brewers. His schooling ended at sixteen, at which time he became bookkeeper and cashier in a clothing establishment in Amsterdam.[35] A few years later he returned to Delft, married at the age of twenty-two, and proceeded to devote the remainder of his life to the study of natural history. His first publication referring to microscopic objects did not appear until 1673, when he was forty-one years old.

From the standpoint of bacteriology, which in the nineteenth century was to effect such a radical alteration in man's concepts of disease processes, the unique importance of van Leeuwenhoek lies in the fact that he was the first to see and accurately describe bacteria. In a letter to The Royal Society of London, dated September 17, 1683[36] (incidentally, van Leeuwenhoek was a most industrious letter writer; the number of letters, actually his scientific writings, which he sent to The Royal Society of London alone was 375) he thus delightfully records his microscopic observations upon some tartar which he scraped from his teeth:

> Though my teeth are kept usually very clean, nevertheless when I view them with a Magnifying Glass, I find growing between them a little white matter as thick as wetted flower: in this substance though I could not perceive any motion, I judge there might probably be living Creatures.
>
> I therefore took some of this flower and mixt it either with pure rain water wherein were no animals; or else with some of my Spittle (having no Air bubbles to cause a motion in it) and then to my great surprise perceived that the aforesaid matter contained very many small living Animals, which moved themselves very extravagantly. The biggest sort had the shape of A (see Fig. 1), their motion was strong and nimble, and they darted themselves thro' the water or spittle, as a Jack or Pike darts thro the water. These were generally not many in number. The 2nd sort had the shape of B; these spun about like a top, and took a course sometimes on one side, as is shown at C and D; they were more in number than the first. In the 3rd sort I could not well distinguish the Figure, for sometimes it seemed to be an Oval, and other times a Circle. These were so small that they seem'd no bigger than

E and therewithal so swift, that I can compare them to nothing better than a swarm of Flies or Gnats, flying and turning among one another

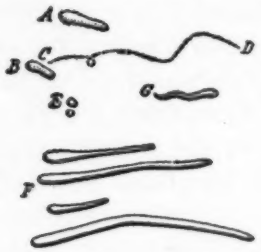

FIG. 1. First pectorial representation of bacteria. Leeuwenhoek, 1683.

in a small space. Of this sort I believe there might be many thousands in a quantity of water no bigger than a sand, tho the flower were but the 9th part of the water or spittle containing it.

Besides these Animals there were a great quantity of streaks or threds of different lengths, but like thickness, lying confusedly together, some bent, and some straight as at F. These had no motion or life in them, for I well observed them, having formerly seen live-Animals in water of the same figure.

Leeuwenhoek extended his observations to others: two women; a child of eight years; the spittle of an "old Man that had lived soberly;" and another old man who was "a good fellow." The substance upon and between the teeth of the old men "had a great many living Creatures, swimming nimbler than I had hitherto seen":

The biggest sort were numerous, and as they moved, bent themselves like G. The other sorts of Animals were in great numbers, insomuch that tho the meal were little, yet the water that it was mixt with seemed to be all alive; there were also the long threads above mentioned.

In addition to his unique distinction of being the first man to see and accurately describe bacteria, van Leeuwenhoek has other signal discoveries to his credit. He was the first to describe the spermatozoa (1674); he gave the first complete description of red blood cells (1674); he was the first to see and describe parasitic protozoa (1674) and entozoic protozoa (Giardia) in 1681. According to Nuttall,[37] it was van Leeuwenhoek's observation that the flea may be attacked by a mite which gave rise to the well-known lines of Swift (1667–1745):

So, naturalists observe, a flea
Has smaller fleas that on him prey;
And these have smaller still to bite 'em,
And so proceed, ad infinitum.

He also was the first completely to demonstrate the capillary connection between arteries and veins, thereby forging the final link in the chain of Harvey's discovery of the circulation of the blood. Read what he wrote upon examining the tail of a tadpole under his microscope:

A sight presented itself more delightful than any mine eyes had ever beheld; for here I discovered more than fifty circulations of the blood in different places, while the animal lay quiet in the water, and I could bring it before my microscope to my wish. For I saw not only that in many places the blood was conveyed through exceedingly minute vessels, from the middle of the tail toward the edges, but that each of the vessels had a curve or turning, and carried the blood back toward the middle of the tail, in order to be again conveyed to the heart. Hereby it plainly appeared to me that the blood-vessels which I now saw in the animal, and which bear the names of arteries and veins are, in fact, one and the same; that is to say, that they are properly termed arteries so long as they convey the blood to the furthest extremities of its vessels, and veins when they bring it back to the heart. And thus it appears that an artery and a vein are one and the same vessel prolonged and extended.

He was also the discoverer of the branched character of heart muscle, of the stripe in voluntary muscle, and of the structure of the crystalline lens.

What was the nature of the microscopic paraphernalia which this wizard of the seventeenth century possessed? In his hands, the simple microscope and simple lenses received their highest development. He manufactured and ground lenses with diamond dust and fastened them himself

to stages. He manufactured and owned 419 lenses and 247 microscopes, a few of which he presented to the Royal Society of London, where they are still to be seen. Charles Singer, who has tested these instruments, says that their highest magnification is about 160 diameters. Other simple microscopes which van Leeuwenhoek made magnified from 40 to 133 diameters.

Rise of the Theoretical Systematists. Harvey's demonstration of the circulation of the blood, published in 1628, and the development of mathematics and physical sciences, brought about a fundamental change in the habits of medical thought during the latter half of the seventeenth century, as well as through the eighteenth century. In the wake of Harvey's discovery, which showed that many of the vital processes of the human body are explainable by the ordinary laws of mechanics, there arose schools or systems of medical theorists which attempted to explain disease, and to establish medicine, on a physiological or mechanical basis. All of these theoretical systematists, handicapped by the incomplete scientific knowledge of their times and by their tendency to stress one explanation of bodily processes in health and disease to the exclusion of all others, founded schools of medical thought which have failed to survive. Historically, however, they represent the courageous, though often misguided, attempt to explain bodily behavior, normal and abnormal, in terms of mechanics, physics and chemistry. Before considering these schools of thought, we would pause to take up an eccentric mystic systematist of the early part of the seventeenth century, Van Helmont.

J. B. van Helmont (1578–1644) was a highly educated Belgian of noble family; he has been termed the "Descartes of Medicine."[38] The theory which he advanced to explain disease actually represented the ideas of Paracelsus, dressed in somewhat more complicated and fantastic trappings. Van Helmont taught that disease arose from a conflict between the Archaeus, or spirit of life, situated in the stomach, and the secondary Archaeus in the kidneys and liver; over both was supposed to preside the vital principle, which resided in the stomach and spleen. Health resulted when the body was ruled by a happy and contented Archaeus; disease arose when the Archaeus, or ruling spirit, became disturbed. Fever arose from injury done to the Archaeus by the cause of the fever; the period of chills was an expression of the Archaeus' terror or passion; and the heat an expression of its fury. Van Helmont, a believer in the doctrine of animism, considered disease to be something active, and not a mere impairment of health; among the occasional causes of disease he listed demons, witches, ghosts and necromancers. Van Helmont is also of interest because he based his system of physiology on the theory of fermentations. He taught that the food absorbed from the intestines becomes endowed with natural spirits in the liver; then, in the heart, the natural spirits are converted into vital spirits, and in the brain the vital spirits become animal spirits. He took issue with Paracelsus, who claimed that the three elements are sulphur, mercury and salts, and contended that there are only two elements, air (the natural atmosphere) and water; but he largely followed, in his system, the main outlines of Paracelsus' chemical theories.

Sylvius and the Iatrochemical School. Sylvius (1614–1672), sometimes referred to by his full name Sylvius de la Boe, was a member of a French family settled in Holland. Professor of medicine at Leyden for fourteen years, his lectures and clinics caused students to flock to him from all over Europe. He was the founder of the so-called Iatrochemical School, which really represented a premature but honest attempt on the part of Sylvius to explain disease on the basis of the new chemical concepts, as well as upon the new doctrine of the circulation of the blood. The doctrines of Sylvius attained widespread

acceptance in Holland and Germany, particularly.

The system which Sylvius proposed was based essentially upon the Hippocratic idea of humors. However, instead of the four cardinal humors of Hippocrates, Sylvius adopted a triumvirate, the saliva, the pancreatic fluid, and the bile. For the "forces" he substituted fermentation and effervescence; for the "qualities" acid and alkali, originating in the acid or alkaline salt. Saliva and pancreatic fluid, Sylvius taught, are acid; bile is alkaline. Health consists in the undisturbed performance, in the body, of fermentation, without the appearance of the acid or alkaline salt. If, however, one of these latter salts becomes prominent, it gives rise to an "acridity" and furnishes the cause of disease.

He divided all diseases into two groups: (1) those depending upon an acid acidity and (2) those originating in an alkaline acidity. Numerous modifications of the two varieties of acidity may occur, and hence arise subordinate classes of the two main groups of diseases. Sylvius' therapy consisted in the administration of alkali to remove the acid, or of acid to remove the alkali. An idea of his line of reasoning can be gained from the following quotation from his writings:

> As often as the whole blood appears black, it indicates that acidity predominates; if the blood is redder, it shows that the bile in it is superabundant. In the first case, that acid in the blood must be diminished; in the second the bile must be lessened and its power broken. If the blood, which normally is free from odor and of a sweetish taste (especially the serum), tastes salty, the alkali in the body is too pure, and when brought into contact with the acid spiritus engenders a humor of a saline taste and prejudicial to the body; for such a taste, though milder, may pass into the urine, but not into the serum or its products, the lymph, the pancreatic juice and the saliva. This saline taste indicates a reduction and correction of the alkali.

Borelli and the Iatrophysical School. Opposed to the Iatrochemical School which did stand in rather close relation to practical medicine, G. A. Borelli (1608–1679) founded the Iatrophysical School. The keynote of Borelli's teaching was that all of the phenomena of health and disease can be reduced to physical and mechanical processes. Bone and muscle movements were explained on the lever theory; digestion was looked upon as being essentially a process of mechanical trituration, or grinding. Not alone in physiology, but into the domain of pathology as well, the school of Borelli entered, and disease, and its various symptoms, were explained on a mechanical basis.

Progress in Clinical Observation. In striking contrast to these opposing schools of medical thought, there arose in England during the seventeenth century Thomas Sydenham, who refused to become a partisan of any school and who exerted a pronounced influence by his insistence that scientists leave by their theorizing until more facts had been ascertained by careful, painstaking clinical observation of disease phenomena.

Sydenham (1624–1689). A contemporary of van Leeuwenhoek, Thomas Sydenham, in England, marked an epoch by his clinical descriptions and observations, particularly of hysteria, gout, scarlet fever, and the form of chorea still known by his name. He was a rebel and an iconoclast, who took his degree in Medicine at Cambridge in 1676, and has been called the "English Hippocrates" because he, more than any other man, revived the Hippocratic tradition in medicine. When once asked as to the best authors to read for acquiring knowledge of medical practice, he told his inquirer to read Don Quixote.

Sydenham, whose influence on seventeenth century medicine was great, was an acute clinical observer unenslaved by theories in his practice, although he failed to rid himself of all the hypotheses of the Galenic School. As affording an insight into his general method of approach to the phenomena of disease, the following ex-

tract from the dedication of his treatise "Medical Observations on the History and Cure of Acute Diseases" is representative of his common sense:

> The only means of acquiring a correct knowledge of the fundamental principles of medicine consists in attentive observation of the whole of the phenomena of disease, and vigilant and minute inquiry into the progress and fluctuations of the several symptoms, from which alone the true and natural indications of cure can be deduced.

And in the opening paragraphs of the same treatise, Sydenham re-iterates the Hippocratic definition of disease:

> A disease, in my opinion, how prejudicial soever its causes may be to the body, is no more than a vigorous effort of Nature to throw off the morbific matter, and thus recover the body. For as God has been pleased so to create mankind, that they should be fitted to receive various impressions from without, they could not, upon this account, but be liable to different disorders; which arise (1) either from such particles of the air, as having a disagreement with the juices, insinuate themselves into the body, for want of its being able to digest, and discharge them, on account of their too large bulk, or unsuitable nature . . . These circumstances being so closely interwoven with our constitutions that no man can be entirely free from them, Nature provides such a method, and train of symptoms, as may expel the peccant matter that would otherwise destroy the human fabric.

Of value in giving an insight into the curiously chaotic ideas concerning the nature of disease held by one of the most acute medical observers of the seventeenth century, the following quotations from Sydenham's writings are of interest: "Acute diseases come from God, but chronical diseases originate with ourselves." Although Sydenham writes of smallpox as "infecting whole families and sparing none, of what age soever they be, if they have not had this disease already," he goes on to say: "I ingenuously acknowledge, that by reason of a defect in the understanding which is common to me and the rest of mankind, I know not the essence of this disease." On another page he reveals his real view, which is Galenical in origin; "the constitution of the air being not so inclinable to produce the Bloody-Flux gave occasion to the Small Pox." Sydenham, himself, regarded his work as merely an initial stage in the description of diseases. "I am like a grindstone," he once said, "which, without itself being able to cut, yet continually whets the iron."

The stress which Sydenham laid upon the influence of season and climate on infectious diseases has led certain writers to characterize Sydenham as "the first great epidemiologist."[39] Payne[40] summarizes Sydenham's contribution in a peculiarly apt manner:

> His great merit was to proclaim the great truth that science was, is, and always must be incomplete; and that danger lurks in the natural tendency to act upon it as if it were complete. The practical man has to be guided not only by positive knowledge, but by much that is imperfectly known. He must listen to the hints of Nature as well as to her clear utterances.

Sydenham was not alone, among seventeenth century physicians, in devoting close attention to the natural history of disease. Arnold de Boot, a Frisian practicing in Ireland, described in 1649 rickets, a hitherto undescribed disease, and Francis Glisson, in 1651, still further extended de Boot's observations. Isbrand de Diemerbroek, in his "De Peste" (1646) carefully described bubonic plague and, in 1665 the first autopsy upon a plague victim appears to have been performed by Nathanial Hodges, of London.

The Doctrine of Spontaneous Generation. The belief in spontaneous generation, or the doctrine of abiogenesis, was widely held in ancient times and throughout the Middle Ages. It postulated that living things are spontaneously generated from non-living material. The Bible and Aristotle record the widespread prevalence of this belief. Pliny (23–79 A.D.)

speaks of frogs and mice begot of the mud of the river Nile. The dew was thought to give rise to insects. Bees generated from the flesh of lions were thought to be stronger and more courageous than those sprung from the flesh of bullocks. Van Helmont, in the sixteenth century, gave a celebrated recipe for creating mice; all that is required is to place some dirty linen in a receptacle, along with a few grains of wheat or a piece of cheese. And somewhat later an Italian, Buonanni, announced that certain timber-wood after rotting in the sea, produced worms, which in turn engendered butterflies, and these butterflies, in turn, became birds. Even as late as the seventeenth century, when Sir Thomas Brown expressed doubt that mice are bred by putrefaction, the English naturalist Alexander Ross replied:

> So may we doubt whether in cheese and timber worms are generated, or if beetles and wasps in cow-dung, or if butter-flies, locusts, shell-fish, snails, eels, and such life be procreated of putrefied matter, which is to receive the form of that creature to which it is by formative power disposed. To question this is to question reason, sense, and experience. If he doubts this, let him go to Egypt, and there he will find the fields swarming with mice begot of Nylus, to the great calamity of the inhabitants.

Redi. It is a strange fact that it was not until the year 1668 that the doctrine of spontaneous generation was subjected to its first experimental test. The man to whom credit is due for this epoch-making venture was Francesco Redi (1626–1697), an Italian physician living in Arentino. Medical adviser to two of the grand dukes of Tuscany, poet, (his best known poem "Bacco in Tuscana" is in praise of the various Tuscan wines), linguist, naturalist, as well as physician, his collected works, embracing nine volumes, one of which was of sonnets, were published in Milan in 1809–1811.

In addition to his monumental demonstration of the falsity of the doctrine of the spontaneous generation of visible plants and animals, Redi was the first to demonstrate ascaris eggs and the first to demonstrate the reproductive organs in the ascaris of man. In his monograph entitled "Osservaziono Intorno agli Animali Viventi che si trovano negli animali viventi" (1684), he described 108 different species of parasites, of man and various animals, belonging to the cestodes, trematodes, nematodes, insects, etc., a work which has earned him the title of "the father of parasitology." In commenting on the fact that he was unable to find pediculi on lions and tigers he naively noted: "The search for parasites on these animals is attended with considerable difficulty."

The volume in which Redi recorded his experiments on spontaneous generation was published in quarto form in Florence in 1668, and was entitled "Esperienze Intorno alla Generazione degl' Insetti" (Experience Met with in the Generation of Insects). In twenty years five editions of this work had appeared. Simple and homely were these experiments, directed specifically against the prevailing belief, held for thousands of years, that maggots were spontaneously generated in decaying meat. He placed meat in a series of wide-mouthed flasks or jars; some he left freely open to the air; others he covered with paper; and the remainder he covered with a fine Neopolitan veil. In all these vessels, the meat decayed, and flies were attracted by the smell. He watched the flies crawl down into the open vessels, when they deposited their eggs on the putrid meat, and soon from the eggs came a large crop of maggots; and later from the maggots developed new flies. The meat in the covered flasks likewise decayed, but no maggots developed in the meat; however on top of the veil which covered certain of the flasks, high above the decaying meat, flies laid their eggs, and then the hatched maggots appeared on the surface of the veil, but not in the meat or within the vessel.

From these very simple experiments, and their profoundly important implication

that the experimental method is the most efficient means of learning the truth concerning biological phenomena, Redi drew the perfectly valid conclusion that maggots arise in decaying meat from the hatching of eggs of flies, and not by spontaneous generation. In Redi's own words:

> Although content to be corrected by anyone wiser than myself, if I should make erroneous statements, I shall express my belief that the Earth, after having brought forth the first plants and animals at the beginning by order of the Supreme and Omnipotent Creator, has never since produced any kind of plants or animals, either perfect or imperfect; and everything which we know in past or present time she has produced, came solely from true seeds of the plants and animals themselves, which thus, through means of their own, preserve their species.[41]

Confirmation and extension of Redi's findings at the hands of Swammerdam (1637–1681) and Vallisnieri, (1661–1730) the latter being a medical professor in Padua, Italy, who showed that the grub in a fruit also arises from an egg laid by an insect before the fruit develops, served to explode the idea that forms of life visible to the naked eye are capable of spontaneous generation. But as so frequently happens, an erroneous, long-held doctrine, when driven from one corner, finds refuge in another which is less clearly lighted. A few years after Redi's experiments were published, van Leeuwenhoek, as we have already seen, discovered infusoria and then still minuter living forms, the bacteria. These microscopic microorganisms, hitherto unseen, represented the haven in which the adherents of the theory of spontaneous generation took refuge. "Granted," they said, "that Redi has forever disproven that animals and insects visible to the naked eye are not spontaneously generated! Microscopic organisms *are* spontaneously generated, and it is in them that are to be found the beginnings of life, the point where lifeless, inorganic matter is changed by natural agencies into organized, but microscopic life." And so the matter stood for seventy years, until the early part of the eighteenth century, when Needham entered the lists with what he claimed to be experimental proof of the spontaneous generation of microscopic animalcula.

Popular Seventeenth Century Ideas Regarding Disease. Enough has been written to make it quite evident that the ideas held by scientists during the seventeenth century regarding the nature of disease were in a chaotic state. One school looked upon disease as an obstruction of the blood vessels and therefore recommended deobstruent remedies to dilute the blood. (In this connection Willis, one of the leading physicians of the seventeenth century, writing on inflammation of the lungs, said that he believed the essential cause to be: "that the blood boiled feverishly, and sticking within the more narrow passages of the lungs engendered there an obstruction, causing inflammation.") Another school taught that disease was explainable in terms of acidity, and therefore employed alkaline treatment. Others held to the theory of vitiated humors, and recommended removal of the "peccant humor" by the use of purgatives, diuretics, bloodletting and sweating, methods to which the great Sydenham was partial. It is not strange that in this chaos of scientific thought the seventeenth century layman, whose knowledge always lags behind the advances of science, should have harbored conflicting and often bizzare notions concerning the diseases which afflicted him.

Moliere's satirical picture of a physician illustrates one phase of the situation in his time (1622–1673):

> Above everything, that which pleases me in him, and in which he follows my example, is that he attaches himself blindly to the opinions of our fore-fathers, and that he has never chosen either to comprehend or to listen to the reasons and the experiments of those pretended discoveries of our age touching the circulation of the blood and other opinions of the same kidney.

In another place, Moliere says: "My physician comes to see me and we talk together. He gives me advice. I neglect to follow it, and I get well."

The most graphic popular account of a great seventeenth century epidemic is to be found in Daniel Defoe's "A Journal of the Plague Year; being observations or memorials of the most remarkable occurrences, as well public as private, which happened in London during the last great visitation in 1665." After mentioning a comet which appeared shortly before the plague broke out, Defoe[42] writes:

> The apprehensions of the people were likewise strangely increased by the error of the times, in which, I think, the people, from what principle I cannot imagine, were more addicted to prophecies and astrological conjurations, dreams, and old wives' tales than ever they were before or since.
>
> But there was still another madness beyond all this, which may serve to give an idea of the distracted humour of the poor people at that time, and this was their following a worse sort of deceivers than any of these; for these petty thieves only deluded them to pick their pockets and get their money, in which their wickedness, whatever it was, lay chiefly on the side of the deceivers deceiving, not upon the deceived. But in this part I am going to mention it lay chiefly in the people deceived, or equally in both, and this was in wearing charms, philtres, exorcisms, amulets, and I know not what preparations, to fortify the body with them against the plague; as if the plague was not the hand of God, but a kind of a possession of an evil spirit, and that it was to be kept off with crossings, signs of the zodiac, papers tied up with so many knots, and certain figures or words written on them, as particularly the word Abracadabra, formed in triangle or pyramid.

A particularly good exposition of the chaotic ideas in regard to disease is to be found in the following quotation, also from Defoe's Journal:[44]

> This put it out of question to me, that the calamity was spread by infection; that is to say, by some certain steams or fumes, which the physicians call effluvia, by the breath, or by the sweat, or by the stench of the sores of the sick persons, or some other way, perhaps, beyond even the reach of the physicians themselves, which effluvia affected the sound who came within certain distance of the sick, immediately penetrating the vital parts of the said sound persons, putting their blood into an immediate ferment, and agitating their spirits to that degree which it was found they were agitated; and so those newly infected persons communicated it in the same manner to others. And this I shall give some instances of, that cannot but convince those who seriously consider it; and I cannot but with some wonder find some people, now the contagion is over, talk of its being an immediate stroke from Heaven, without the agency of means, having commission to strike this and that particular person, and none other, which I look upon with contempt as the effect of manifest ignorance and enthusiasm; likewise the opinion of others, who talk of infection being carried on by the air only, by carrying with it vast numbers of insects and visible creatures, who enter into the body with the breath, or even at the pores with the air, and there generate or emit most acute poisons, or poisonous ovae or eggs, which mingle themselves with the blood, and so infect the body; a discourse full of learned simplicity, and manifested to be so by universal experience; but I shall say more to this case in its order.

THE EIGHTEENTH CENTURY

Spallanzani and Spontaneous Generation. We have seen how the seventeenth century was torn with dissension over the question of spontaneous generation. Throughout the eighteenth century the controversy waged, and here we find the two outstanding antagonists to be Needham and Spallanzani.

Needham (1713–1784) was an Englishman, and a Catholic priest residing on the Continent, who was for many years Director of the Academy of Maria Theresa at Brussels. He became a friend of Buffon (1707–1788), the French naturalist, with whom he performed and published many of his experiments. The results of Needham's experiments were first published in 1748. He announced that he had taken some meat extract, obtained by boiling meat in water, as well as vegetable infusions of

seeds and almonds, into flasks or vials which he then carefully corked with porous cork stoppers, and sealed with mastic. He then heated these flasks for a short time by immersing them in boiling water, and in hot ashes. After the flasks had cooled, he set them aside at room temperature for several days, when lo and behold he found his sealed flasks to be literally teeming with animalcules, when he examined a drop of their contents under a microscope. Inasmuch as Needham was convinced that the heating had killed all the germs that may have been present in the flasks, he victoriously announced that the living forms which developed in the flasks had been produced by spontaneous generation. In addition, Needham promulgated an explanation of the spontaneous generation of life, which Buffon later elaborated into a system which became quite the social rage at the French Court. Needham said that the thing which caused little animals to appear in his heated infusions was a force, the vegetative or productive force; and this force has the function of forming the organic world. Buffon still further elaborated this idea. Animals and vegetables, he said, possess certain primitive, deathless parts, or organic molecules, in common. These organic molecules cast themselves into the moulds or shapes which constitute different living beings. When a living thing, be it animal or plant, is destroyed by death, the immortal, ever active organic molecules become liberated. Thereupon they become active in the putrified material, appropriate to themselves some raw particles and form, writes Buffon, "by their reunion, a multitude of little organized bodies, of which some, like earthworms, and fungi, seem to be fair-sized animals or vegetables, but of which others, in almost infinite numbers, can only be seen through the microscope." Not alone fair-sized animals and vegetables, such as earthworms and fungi and also microscopic animalcules did he believe arose and existed only through spontaneous generation, but intestinal worms as well. And he adds: "The eels in flour paste, those of vinegar, all those so-called microscopic animals, are but different shapes taken spontaneously, according to circumstances, by that ever active matter which only tends to organization."

Now enters into the experimental lists a fellow-countryman of Redi, Lazzaro Spallanzani (1729–1799), a man educated for the Catholic Church (and hence usually known as Abbe Spallanzani), but whose love of natural science and experimentation led him into research and teaching. In addition to his studies on spontaneous generation, his scientific contributions to the physiology of fertilization, of digestion, and of respiration were of far-reaching import. Of his studies on gastric digestion, Beaumont wrote:[45]

> Suffice it to say, that the theories of concoction, putrefaction, trituration, fermentation and maceration have been prostrated in the dust before the lights of science and the deductions of experiment. It was reserved for Spallanzani to overthrow all these unfounded hypotheses, and to erect upon their ruins a theory which will stand the test of scientific examination and experiment. He established a theory of chemical solution, and taught that chymification was owing to the solvent action of a fluid, secreted by the stomach, and operating as a true menstrum of alimentary substances. To this fluid he gave the name of gastric juice.

First a professor at Bologna, he later was called to a professorship at the University of Pavia, in Lombardy.

Spallanzani suspected the precision with which Needham's experiments had been performed; he suspected that Needham had not subjected his flasks to a sufficient degree of heat to kill the contained animalcula; for Needham had not recorded the degree of temperature, nor the length of time, to which his flasks had been subjected. Moreover, he suspected the porous stoppers which Needham had used for sealing his flasks, stoppers which, he suspected, might perhaps have allowed the ingress of outside microorganisms. First,

Spallanzani introduced an important technical innovation in the experimental study of this question of the spontaneous generation of life, by employing glass flasks with slender necks which he hermetically sealed after the nutrient liquids, juices of meats and vegetables, had been introduced into the flasks.

Let Spallanzani describe the results of his experiments in his own words:

> I repeated that experiment with more accuracy. I used hermetically sealed vases. I kept them for an hour in boiling water, and after having opened them and examined their contents within a reasonable time I found not the slightest trace of animalculae, though I had examined with the microscope the infusions from nineteen different vases.

From these experiments Spallanzani drew the conclusion that living material, such as animalculae, always originate from other living material. The results of Spallanzani's experiments were published in 1775, one year before the outbreak of the American Revolution.

But Needham was not defeated. He retorted that by leaving his vases in boiling water for an hour, Spallanzani had not only destroyed the contained animalculae, but he had weakened, or perhaps killed, the germinative or "vegetative" force of the infusion itself, from which force Needham contended that animalculae are generated. He advised that Spallanzani try subjecting his vases to less heat.

It must be admitted that Spallanzani did not completely succeed in disproving Needham's arguments. He did, however, conclusively demonstrate that, no matter how long the infusions in the flasks were boiled, if now the infusions again were exposed to the air, animalculae appeared within a few days. In view of subsequent discoveries of bacterial spores, whose resistance is such that they can withstand boiling water for several hours, it must be noted that there was perhaps an element of luck in the success of Spallanzani's experiments, possibly partly due to the purity of the air in which he worked.

Voltaire laughed at Needham and, for the amusement of his readers, called him an Irish Jesuit. In his "Philosophic Dictionary," he wrote: "It is very strange that men should deny a creator and yet attribute to themselves the power of creating eels." However, even as late as 1846, Ernest Bersot, who later became a director of the École Normale in France, wrote in his book Spiritualism:

> The doctrine of spontaneous generation pleases simplicity-loving minds; it leads them far beyond their own expectations. But it is yet only a private opinion; and, were it recognized, it would have to be limited and narrowed down to the production of a few inferior animals.

It is curious to find how one of the great scientific events of the eighteenth century, the discovery of oxygen by Priestley in 1774, influenced the hotly debated question of the spontaneous generation of life. For, now, the proponents of this theory said: "Since oxygen is necessary to all forms of life, had not the boiling of Spellanzani's sealed flasks changed the oxygen in such a manner that its life-giving properties had been destroyed?" And it is also of interest to note that it was not until 1860, and thereafter, that this ubiquitous specter of spontaneous generation was finally laid low by the epoch-making researches of Pasteur.

Plenciz and the Contagionum Vivum Theory of Disease. Van Leeuwenhoek, it will be remembered, died in 1723, but it was in 1683 that he announced his discovery of bacteria. It is of interest to note that an anatomist, Giovanni Maria Lancisi (1654–1720), the author of a classical work on diseases of the heart, published in the early part of the eighteenth century an essay entitled "Swamp Emanations and Their Cure" (1717). In this, he quite definitely traced the relation between swamp fevers and the mosquito, and considered the possibility, without adducing proof, of an infected insect causing, by its bite, "worms in the blood;" he

suggested that the cure for swamp fevers lay in the drainage of swamps.

For years the possible relation of Van Leeuwenhoek's "animalcules" to disease remained unsuspected and it was not until 1762, seventy-nine years after Van Leeuwenhoek's discovery of bacteria and thirty-nine years after his death, that the possible significance of bacteria was first recognized. It was in 1762, then, that Plenciz, a Vienna physician, announced a more or less definite *contagium vivum* theory of the causation of disease. Although the conclusions that he drew were not warranted by the experimental observations that he made, yet the fact remains that Plenciz held that each disease has its own living, specific, exciting agent which, upon entrance into the body, multiplies enormously and gives rise to the lesions and symptoms of that disease. He found animalcula in various sorts of decomposing materials, and, apparently he was the first to describe "the bread ferment." From Plenciz on, the *contagionum vivum* doctrine was bound up with theories of fermentation, decomposition and spontaneous generation. It is curious that in the seventeenth century Robert Boyle (1627–1691), the noted physicist, prophesied that the explanation of the causation of disease would be found in the explanation of fermentation. In his essay on the "Pathological Part of Physic" he wrote:

> And let me add that he, that thoroughly understands the nature of ferments and fermentation, shall probably be much better able than he that ignores them to give a fair account of divers phenomena of several diseases (as well as fevers and others) which will, perhaps, be never properly understood without an insight into the doctrine of fermentation.

However, so little was actually known about bacteria that Linnaeus, the founder of nomenclature in natural history, classified bacteria in 1758 in one group which he called Chaos. A rather distinct advance in the knowledge of microorganisms is marked by the treatise of Otto Friedrich Muller, of Copenhagen, a work published in 1786 and entitled: "Animalcula Infusoria," a volume of 367 pages. Muller used, in his studies, a compound microscope, invented by the Janssens and improved by Fontana, which gave a magnification of 300 diameters. In this book not only did Muller have fifty plates of sketches of infusoria, but he attempted a crude classification and introduced such terms as "Proteus" and "Vibrio," which have retained to the present day much of their original significance.

FURTHER THEORETICAL SYSTEMATISTS

The Iatromathematicists. The endeavor, which began in the seventeenth century, to find complete theoretical systems which would explain health and disease was continued throughout the eighteenth century. As a continuation of the Iatrophysical School of the preceding century, as well as an attempt to apply Newton's (1652–1713) astronomical generalizations to the field of medicine, there arose in England a group of physicians who endeavored to reduce the phenomena of health and disease to mathematical terms and doctrines. Richard Mead (1673–1754), author of "Mechanical Account of Poisons" (1702) and "The Power of the Sun and Moon over Human Bodies" (1704) was not only an eminently successful physician but a man of great learning. He wrote:

> It is very evident that all other means of improving medicine have been found ineffectual, by the stand it was at for two thousand years, and that, since mathematicians have set themselves to the study of it, men already begin to talk so intelligently and comprehensibly, even about abstruse matters, that it is to be hoped that mathematical learning will be the distinguishing mark of a physician and a quack.

In his treatise published in 1704, Mead endeavored to explain disease in terms of atmospheric pressure and by solar and lunar influences. Archibald Pitcairne (1652–1713), George Cheyne (1671–1743), John Freind (1675–1728) and William Cole (1635–1716) were distinguished English

contemporaries who elaborated upon the teachings of the Italian Iastromechanical School of the seventeenth century. Their endeavor was to explain not only such physiological processes as menstruation by principles of mechanics, but the causation of fevers and the action of poisons as well.

Boerhaave. Hermann Boerhaave (1668–1738) is notable as being one of the greatest physicians of the eighteenth century and one of the great medical teachers of all time. Professor of medicine at Leiden, his fame was so wide that letters addressed "Dr. Boerhaave, Europe" were laid upon his table, and the hospital of Leiden, with its mere dozen beds available for teaching, became the center of medical influence in Europe. An avowed and enthusiastic disciple of the methods of Hippocrates and Sydenham, Boerhaave unceasingly stressed the importance of applying physiological, anatomical and microscopic discoveries to the practice of medicine, thereby becoming one of the pioneers in modern methods of clinical instruction.

In the ideas which he held as to the nature of disease processes, Boerhaave is generally regarded as belonging to the Iatromechanical School of Borelli, although he is said to have also taught the acid and alkaline acidity theory. He held that disease is a condition in which the bodily actions are disturbed, which takes place only with difficulty. Fever, he taught, is the effort of nature to ward off death.

Stahl and Hoffmann. George Stahl (1660–1734), a professor of medicine at Halle, elaborated an animistic theory of disease which was a direct protest against certain of the current material concepts. He taught that the life of all lower animals was subject to mechanical, materialistic laws, but that man constituted the unique exception among living beings. In man, the thing of supreme importance is the "soul" or "anima." The special end of the human body, he believed, is to house the soul; all chemical and physical processes of the body are governed by this sensitive "anima," which pervades all bodily parts and presides over all events. When the body is diseased, the symptoms are the efforts of the soul to free itself from morbid influences, and to restore normal movements in the organism.

Friedrich Hoffmann (1660–1742) was the first professor of medicine in the University of Halle, being appointed in 1693, and Stahl was one of his colleagues. Apparently he endeavored to reconcile the "spiritual" and "material" theories of health and disease. He taught that life depends upon a universally diffused ether in the atmosphere. Animals, including man, breathe in the ether, which pervades the entire body; accumulating in the brain it generates the "nervous fluid" or pneuma. Health is dependent upon the maintenance of a proper body "tonus," a composte of regular action and reaction, contraction and relaxation; disease results from a disturbance of this tonus. Hoffmann divided diseases into (1) atonic diseases, due to relaxations in the capillaries of the vascular system, and (2) congestive and inflammatory diseases, caused by contractions of the capillaries.

Sauvages and Cullen. François Boissier de Sauvages (1706–1767) attempted to carry out Sydenham's idea of describing diseases as botanists describe plants. In his "Traité des Classes des Maladies" (1731) and in his larger treatise "Nosologia methodica sistens morborum Classes, Genera et Species" (1763), he enumerated 2400 different kinds of diseases, which he subdivided into 10 classes, these latter into 40 orders, the orders into genera, and the genera into species. What he actually did was to classify every symptom as a disease. Cullen, and others, attempted somewhat similar classifications during the eighteenth century.[46]

William Cullen (1710–1790), professor of medicine at Edinburgh, attempted in his "Nosology or Classification of Diseases" a classification of diseases upon a natural history plan, most of which is now forgotten. Largely influenced by the new

physiological doctrine of irritability expounded by Albrecht von Haller (1708–1777), Cullen attempted to build a system of medicine upon this doctrine. In his "First Lines of the Practice of Physic" he also stresses the importance of nervous action, and he lists "gout" as a neurosis.

Brown and Habnemann. John Brown (1735–1788) was another medical systematist of the eighteenth century whose contemporary fame far outweighed his actual contributions to the advancement of man's ideas of disease. Brown's theory of medicine, sometimes called the Brunonian system, was based upon the property of "excitability." In his own words: "The whole phenomena of life, health as well as disease, consist in stimulus and nothing else." According to his theory, all diseases fall into one of two categories (1) asthenic, to which 97 per cent of all diseases belong and which require stimulating treatment, and (2) sthenic, which require sedative treatment. Brown's wordy, dielectic system, founded on abstract theory, had a great vogue in Italy and Austria, but it retarded rather than advanced medical knowledge.

Hahnemann (1753–1844), the father of homeopathy, was the last of the group of eighteenth century theorizers. Paracelsian in his attitude, he taught that all that matters is a knowledge of symptoms; the attempt to go behind symptoms and discover their causes he considered a bootless task. Morbid anatomy and pathology he discarded. With such a dogmatic and nonscientific method of approach, it is no matter of surprise to find that Hahnemann held most bizarre ideas of disease. His ideas in regard to chronic maladies are particularly quaint; all of them, excepting those caused by medicines, arise from three diseases: (1) psora, or the itch, a skin disease which, when driven inwards, is responsible for seven-eighths of all chronic maladies: (2) syphilis, and (3) sycosis (another skin disease).

It is not fair to end this brief account of eighteenth century theoretical systematists without stressing the fact that the century witnessed the acquisition of a considerable body of actual, practical knowledge of disease. The clinical investigations of John Fothergill on diphtheria and tic douloureux and of John Huxham and John Pringle on epidemic fevers in England are especially notable. And from the Viennese school, during the eighteenth century, appeared an invention whose inestimable value in clinical studies was not recognized until the early part of the following century. This was Leopold Auenbrugger's report of his discovery of a method of diagnosing diseases, particularly of the chest, by direct percussion, published in his "Inventum novum" in 1761. The contributions of Morgagni, Bichat and Jenner will be detailed separately.

The Rise of Modern Pathology. With Morgagni modern pathology begins; in fact it is accurate to state that upon the method of Sydenham and the method of Morgagni much of modern medicine rests. Sydenham's great contribution to the advancement of knowledge of disease lay in his rigid insistence upon the necessity of exact observations on the natural history of disease; Morgagni's inestimable service lay in his insistence upon thoroughness and accuracy of detail in the study of morbid anatomy. Sydenham emphasized the importance of accurately reading the story of disease from the book of the living sick body; Morgagni stressed the importance of reading with scrupulously careful, naked eyes the grewsome story from the telltale marks and lesions that disease leaves upon the bodies of those that it has slain, and attempting to correlate them with the symptoms which the patient presented during his illness.

Giovanni Battista Morgagni (1682–1771) was born in Forli, Italy, and graduated in medicine at Bologna. In 1712 he was called to Padua, where he soon became professor of anatomy. The masterpiece by which he is most widely known is his great book "De Sedibus et Causis Morborum per Anatomen Indagatis" (1761),

which did not appear until he was almost eighty years of age. It really represented a series of letters in which he detailed the fruit of sixty years' intensive study of the appearances encountered by him at post-mortem examinations, as well as of the symptoms during life, in a number of cases of various diseases which he had studied; it actually was a clinical work in which detailed anatomic explanations of disease symptoms were given. In all, the work covers about seven hundred autopsies, most of which Morgagni performed himself. His descriptions of the gross pathology of lesions of the blood vessels, particularly of aneurysms, and his clarification of the confused subject of the symptomatology and gross pathology of pneumonia were particularly masterly, although there was scarcely any phase of "naked eye" pathology, including tumors, which he left untouched.

Morgagni, replying upon naked-eye examinations, thought in terms of whole organs of the body being diseased; he brought the subject of gross pathology far along the road that it has since followed. It remained for Bichat to demonstrate that the various organs of the body are separable into "textures" or tissues, and to show how the separate involvement of different tissues by different diseases gives rise to different morbid symptoms.

Marie-François-Xavier Bichat (1771–1802) spanned in his short and tragic life the revolutionary sunset of the eighteenth century and the first faint dawn of the nineteenth century. Born in Thoirette, France, he studied medicine in Lyons, and in 1794 came to Paris. A sufferer from tuberculosis during all the productive years of his life, he spent the whole of his days in the dissecting room, and wrote at night, dying at the age of thirty-one years. Yet in this short space of eight years which he spent in Paris, Bichat not alone revolutionized anatomy and physiology, but he introduced a new concept into man's ideas of the nature of disease. His "Treatise on Membranes" (1799–1800) is looked upon as constituting the foundation upon which the science of histology has been reared, but his huge "Anatomie generale" (1801–1802) is probably his most classic contribution. In this latter volume he says:

> All animals are an assemblage of different organs, which, executing each a specific function, concur for the preservation of the whole. These in turn are made up of many textures (tissues) of different kinds, which really compose the elements of these organs. Just as chemistry has its simple bodies, uniting to form compounds; so anatomy has its simple tissues which by their combinations make up organs.

Next he distinguishes twenty-one different tissues, including nervous, connective, vascular, muscular, osseous. glandular, etc. In this differentiation of various organs of the body into their component tissues, Bichat did not employ the microscope; he dissected with fine instruments and, as he writes. "submitted tissues to the action of various chemical reagents as heat, air, water, acids, alkalies, salts, desiccation, maceration, putrefaction, boiling, etc., fixing with precision the limits of each organized tissue."[47]

It is to Bichat's everlasting credit that he did not rest content with his morphological discoveries. Prior to him, students of pathology, such as Morgagni, thought almost exclusively in terms of whole organs being diseased. Bichat dissociated morbid changes in an organ into diseases of the various tissues of which the organ is composed, and showed how, frequently, each followed a different course.

THE SCIENTIFIC BEGINNING OF IMMUNOLOGY

Jenner. Although the practice of "variolation," the dangerous practice of passing mild smallpox from one person to another by inoculation of material from smallpox pustules, had been practiced for centuries, it is to Jenner (1749–1823) that the world owes the safer method of smallpox vaccination which it practices today. His pioneer

experimental work on the prevention of smallpox not only marked the beginnings of a new era in medicine, but it constituted the scientific foundation upon which the science of immunology has been erected.

Born at Berkeley, Gloucetshire, England, on May 17, 1749, Jenner went to London in 1770 and became a resident pupil, and a lifelong friend, of the famous surgeon and anatomist, John Hunter. In 1773, he took up the practice of medicine at Berkeley, where he died on January 26, 1823.

The current belief in rural England, as epitomized by the statement of a dairy maid: "I cannot take the smallpox because I have had the cowpox," formed the background of Jenner's discovery. His first, and crucial, experiment in smallpox vaccination (the word vaccination is derived from "*vacca*, a cow) was made on May 14, 1796, when he inoculated James Phipps, a boy of eight years, with cowpox. After the boy's recovery, he inoculated him with virulent smallpox virus, and the boy failed to contract smallpox. Jenner's first paper on his discovery was never printed; it was not until 1798 that his first treatise entitled "An Inquiry into the Causes and Effects of the Variolae Vaccinae, or Cow Pox" appeared. In 1799 was published his second treatise "Further Observations on the Variolae Vaccinae, or Cow Pox" and in 1800 the third, "A Continuation of Facts and Observations Relative to the Variolae Vaccinae, or Cow Pox."[48]

Although the immediate reception given by the medical profession to his discovery was not highly encouraging, yet in 1802 Parliament voted Jenner £10,000 and, in 1806, £20,000 in recognition of the scientific value of his services to humanity, and as early as 1807 Bavaria made vaccination against smallpox compulsory.

Jenner's three treatises constitute the first scientific proof ever advanced that a highly contagious disease such as smallpox is preventable by conveying a closely allied disease, cowpox, to man; as such they can be considered to mark the real beginnings of the science of immunology, whose further development awaited the genius of Pasteur eighty years later. Thomas Jefferson wrote to Jenner the following:

> Medicine has never before produced any single improvement of such utility. Harvey's discovery of the circulation of the blood was a beautiful addition to our knowledge of the ancient economy, but on a review of the practice of medicine before and since that epoch, I do not see any great amelioration which has been derived from that discovery. You have erased from the calendar of human afflications one of its greatest. Yours is the comfortable reflection that Mankind can never forget that you have lived; future generations will know by history only that the loathsome smallpox has existed, and by you has been extirpated.

(To Be Concluded)

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BOOK REVIEWS

An Introduction to Pharmacology and Therapeutics. By J. A. Gunn, Professor of Pharmacology in the Univ. of Oxford. Oxford Univ. Press, 1929.

Professor Gunn has succeeded in condensing within 220 small pages a brief but helpful

introductory survey for medical students, designed to "leave the lecturer more freedom and lattitude to deal with more advanced and advancing aspects of the subjects." The resulting pocket manual is admirably suited for a preliminary review of the subject such as might appeal to first-year medical students before they actually take a course in pharmacology. Presented in quite an elementary manner, it is hardly suited for medical graduates although it might be useful when a rapid review is desired.

In common with the English generally, Professor Gunn unfortunately employs many proprietary names in referring to substances which are official. This and the omission of dosages in the metric system are somewhat contrary to current developments in pharmacology in the United States.

The subject matter is, on the whole, well presented; the material is logically arranged and it makes easy reading. Brief historical notes are offered regarding the more important therapeutic agents. This is distinctly valuable in arousing the student's interest in the material. A few references might have been added to encourage the reading of some of the more important classics in the field. In a very few instances, statements are made contrary to the current opinion. Thus, the old view that strychnine increases the field of vision is reiterated although it has been conclusively demonstrated that this is not the case. There is a good index.

As an introduction to the subject this book may be recommended to those students who may desire to survey the field before beginning an intensive study of it. It is in no sense a text nor has the author intended it to serve as one.

Arthritis and Rheumatoid Conditions. Their Nature and Treatment. By Ralph Pemberton, M.S., M.D. Phila., Lea & Febriger, 1929.

A growing appreciation of the arthritic problem is shown in the widespread movement in Europe toward intensive study and treatment of the disease and provision for better institutional care of sufferers from it. An American committee, of which Dr. Pemberton is chairman, for cooperation in this enterprise held its first meeting in Philadelphia in March, 1928.

In the preface the writer says, "The work has three main purposes: (1) to unite in a connected whole the long series of observations of the writer and his associates, in collaboration with Dr. Robert B. Osgood, of Boston; (2) to attempt some correlation of these observations with critical work of other students of the subject; and (3) chiefly to present to the general practitioner, in a general way, a wide-angled viewpoint and certain basic principles of treatment." The book more than lives up to this promise.

The book opens with a chapter on Arthritis as an Economic Problem. Other chapter headings are: The Etiology of Arthritis and Rheumatoid Conditions, The Pathology of Arthritis, The Symptomatology of Arthritis and Rheumatoid Conditions, The Treatment of Arthritis and Rheumatoid Conditions, The Coordination of Treatment in Arthritis and Rheumatoid Conditions, Arthritis in Childhood: Gonorrheal Arthritis: Acute Rheumatic Fever and Other Allied Conditions, General Considerations Bearing on the Nature and Treatment of Arthritis and Rheumatoid Conditions, and The Results of Treatment.

A book which should be in the hands of every practitioner of medicine and as such we earnestly recommend it.

Treatment by Manipulation. A Practical Handbook for the Practitioner and Student. By A. G. Timbrell Fisher, M.C., F.R.C.S. (Eng.). Ed. 2 of Manipulative Surgery. N. Y., Macmillan Co., 1929.

The second edition of a work which presents the author's belief for more widespread use of manipulation in suitable cases, and as such a very favorable book. That manipulation could to advantage replace surgery in many cases is not to be doubted but the judgement of the attending surgeon is the important factor in each case and this will undoubtedly be improved by reading this book.

Gastro-Intestinal Diseases. Lectures delivered at The James Mackanzie Institute for Clinical Research, St. Andrews. Edited by Prof. David Waterston, M.D., F.R.C.S. (Edin.). N. Y. Oxford Univ. Press, 1928.

This book contains a series of lectures delivered at the James Mackenzie Institute for Clinical Research, St. Andrews, during the autumn of 1927 and, like all compiled works, the essays are of varying values though the selection of authors is such as to place this series way above the average. Of particular interest is lecture three on "Superficial Pain as an Aid in the Differential Diagnosis of Abdominal Disease." This chapter alone, it is felt, will make this book of value to all abdominal surgeons.

The Treatment of Fractures and Dislocations in General Practice. By C. Max Page, D.S.O., M.S. (Lond.), F.R.C.S., and W. Rowley Bristow, M.B., B.S. (Lond.), F.R.C.S. Ed. 3. N. Y., Oxford Univ. Press, 1929.

That a third edition has been called for since 1923 is perhaps the best evidence that this concise and practical manual of less than 300 pages fills a definite need. The various chapters conform with the current and up-to-date methods of treatment and while not as comprehensive as some of the larger works the book may well be recommended to the general practitioner and medical student.

Artificial Sunlight and Its Therapeutic Uses. By Francis Howard Humphris, M.D. (Brux.), F.R.C.P. (Edin.), etc. Ed. 5. N. Y., Oxford Univ. Press, 1929.

No subject is today more generally discussed than the subject of artificial sunlight therapy and no one probably has had more experience than the author of this book who presents in 340 pages a complete and authoritative discourse on all phases of this subject, beginning with "Ultra-Violet Rays Historically Considered" and winding up with a "Bibliography" which would indicate a thorough comprehension of the subject.

The Principles of Electrotherapy and their Practical Application. By W. J. Turrell, D.M., B.CH. (Oxon.), D.M.R. & E. (Cantab.) Ed. 2. N. Y., Oxford Univ. Press, 1929.

Turrell's book, first published in 1922, has now appeared in a second edition, considerably revised and enlarged. Confining itself strictly, in accordance with its title, to the principles of electrotherapy the book may be looked upon as an authoritative and conservative estimate of the present status of electrotherapy.

Diagnosis and Treatment of Deformities in Infancy and Early Childhood. By M. F. Forrester-Brown, M.S., M.D. (Lond.). Foreword by Sir Robert Jones, Bart. N. Y., Oxford Univ. Press, 1929.

No better review of this book could be written than to quote the foreward of Robert Jones: "This able and interesting book should reach a large audience. It is lucid exposition of orthopaedic principles, written by a surgeon with wide knowledge and experience of the subject. It is especially intended for the school doctor, the general practitioner, and those who are interested in Infant Welfare work. It deals largely, and in practical fashion, with preventive treatment, and is a clear and concise guide to the modern treatment of deformity. The author is a worthy disciple of two great teachers—Sir Harold Stiles of Edinburgh and Dr. Goldthwait of Boston, and the lessons taught are of great importance to both the profession and the public." To all of this the reviewer would humbly say "Amen."

Oesophageal Obstruction. Its Pathology, Diagnosis and Treatment. By A. Lawrence Abel, M.S. (Lond.), F.R.C.S. (Eng.). N. Y., Oxford Press, 1929.

A complete, splendidly illustrated monograph on an important and little-known subject. An elaboration of the Jacksonian prize essay of 1924, this book by the assistant surgeon of the London Cancer Hospital covers the subject thoroughly, completely and withal concisely. Any surgeon doing this work will find this book a valuable addition to his library.

Orthopedic Surgery. By Sir Robert Jones, Bart., K.B.E., C.B., and Robert W. Lovett, M.D., F.A.C.S. Ed. 2, revised. N. Y., William Wood & Co., 1929.

Any book with Sir Robert Jones' name attached is bound to command more than ordinary attention from the medical profession. That a second edition should be called for within five years is no more than is to be expected. New chapters have been added to this edition on (1) affections of tendons, muscles and fasciae, (2) peripheral nerve lesions, (3) pyogenic affections of bone; (4) vascular lesions of the extremities; (5) amputations and artificial limbs, and each chapter has been carefully revised. The 800 illustrations leave nothing to be desired and each one "points a moral and adorns a tale." The roentgenograms were made under the supervision of Dr. Thurstan Holland. This is the outstanding text and reference book on orthopedic surgery and as such deserves a place in the library of every surgeon.

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